Review of Completed Project
Hodges Village Dam and Reservoir
Oxford, Massachusetts

Report For Issue Resolution

MAY 1982

US Army Corps of Engineers
New England Division

HODGES VILLAGE DAM AND RESERVOIR

FRENCH RIVER

OXFORD, MASSACHUSETTS

REPORT FOR ISSUE RESOLUTION

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02254

MAY 1982

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HODGES VILLAGE LOW FLOW AUGMENTATION STUDY

OXFORD, MASSACHUSETTS

INTRODUCTION

This report presents the results of intermediate planning, identification and preliminary evaluation of alternatives, and has been prepared for an intermediate stage issue resolution conference. The report is not intended to be a public document and should not be treated as such.

The existing Hodges Village Dam and Reservoir is a single purpose flood control project located on the French River in Oxford, Massachusetts. Completed in 1959, the reservoir is capable of storing 8.0 inches of runoff from its drainage area of 31.1 square miles. Flood control operations since completion of the project have been very successful in reducing downstream damages.

Unrelated to the flood control project, the French River has a serious water quality problem downstream from the dam, particularly during times of low streamflow. To assist in alleviating this condition, the Massachusetts Division of Water Pollution Control and the U.S. Environmental Protection Agency (EPA) have recommended that the Corps examine the feasibility of utilizing reservoir storage at the Hodges Village project to provide low flow augmentation for water quality improvement in the

French River. In addition, as a result of recent wastewater management studies in the area, the EPA has indorsed the need for low flow augmentation. The primary objective of this study is, therefore, to determine the feasibility of modifying the existing project to augment flows in the French River. The study will also address other water resource needs at the project, such as recreation and fish and wildlife management, that may arise as the study progresses.

It is important to note that this report only addresses, in detail, one element (low flow augmentation) of an overall plan to meet water quality goals in the French River. Other elements of the overall plan are being evaluated by other Federal and non-Federal agencies.

STUDY AUTHORITY

This study was authorized by Section 216 of the Flood Control Act of 1970, Title II of Public Law 91-611, which reads as follows:

"The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects, the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or

economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

STUDY PURPOSE AND SCOPE

The purpose of this study is to investigate the feasibility of modifying the existing Hodges Village project to provide downstream flow augmentation and to satisfy other water-related needs in the area. Related needs that have been identified in the project area include recreation and fish and wildlife management. The results of the study will be available for Congressional, interagency and local use in determining the advisability of modifying the original project authorization.

The study area for this investigation was limited to the Hodges Village Dam and Reservoir and the downstream areas that would be impacted by modifying the project. Factors considered during the evaluation of potential modifications to the project, include economic and engineering feasibility, environmental and social impacts, and any other effects of such modifications. The study also included a review of project features, operational procedures, recreational uses and environmental considerations.

STUDY PARTICIPANTS AND COORDINATION

Studies were coordinated with Federal, State and local agencies, as well as concerned individuals. Plan formulation meetings have been held with Oxford town officials in Oxford to present alternative findings, and determine local desires and needs for modifying the project or its operation.

The Massachusetts Division of Water Pollution Control performed the initial water quality studies of the French River, which displayed the need for low flow augmentation to meet the national water quality goals of 1983. More recently, as a result of studies of wastewater treatment alternatives, the EPA has supplied the Corps of Engineers with the benefits accruing from low flow augmentation under the provisions of the Clean Water Act of 1977. The EPA is responsible for determining the need for low flow augmentation, its value and its impacts. The EPA has also provided information on alternative methods of achieving the desired water quality in the French River. Initial coordination with these and other agencies aided in the completion of the Plan of Study (Reconnaissance) Report in December 1975.

Coordination has been maintained with the Federal and State fish and wildlife agencies. This coordination resulted in receipt of a planning aid letter from the U.S. Fish and Wildlife Service on 10 April 1978 and a letter from the Massachusetts Division of Fisheries and Wildlife on 8 June 1979.

In 1978, the Corps began meeting with the French River Task Force. In 1979, this group evolved into the State-EPA Agreement (SEA) Working Group on the Interstate Transport of Pollutants. The SEA Working Group was formed to study several interstate rivers in New England which receive pollutant loads from out-of-state sources causing severe water quality problems. One of the primary problems being studied is the organic loads from Dudley and Webster, Massachusetts, which affect the French River in both Massachusetts and Connecticut. The objective of the SEA Group is to insure that high level cooperative and coordinated pollution control and abatement efforts occur between Connecticut and Massachusetts and affected municipalities. Through a series of quarterly meetings, technical information is transferred and discussed among the various State, Federal and local agencies. Currently, the SEA Group is composed of EPA (Region 1) as lead agency, the States of Massachusetts and Connecticut, the New England Division, Corps of Engineers and the New England Interstate Water Pollution Control Commission. More recently, representatives from the towns of Webster, Dudley and Oxford have taken part in meetings.

Coordination with other agencies and interested parties will continue during the final stage of the study. The details of the selected plan and any required cost sharing arrangements will be emphasized during discussions with the town of Oxford, Commonwealth of Massachusetts and the EPA. Coordination with other agencies and interested groups will be required for evaluation of the selected plan. The majority of this coordination will be accomplished through meetings and correspondence with those interested in or affected by the study.

PRIOR STUDIES AND REPORTS

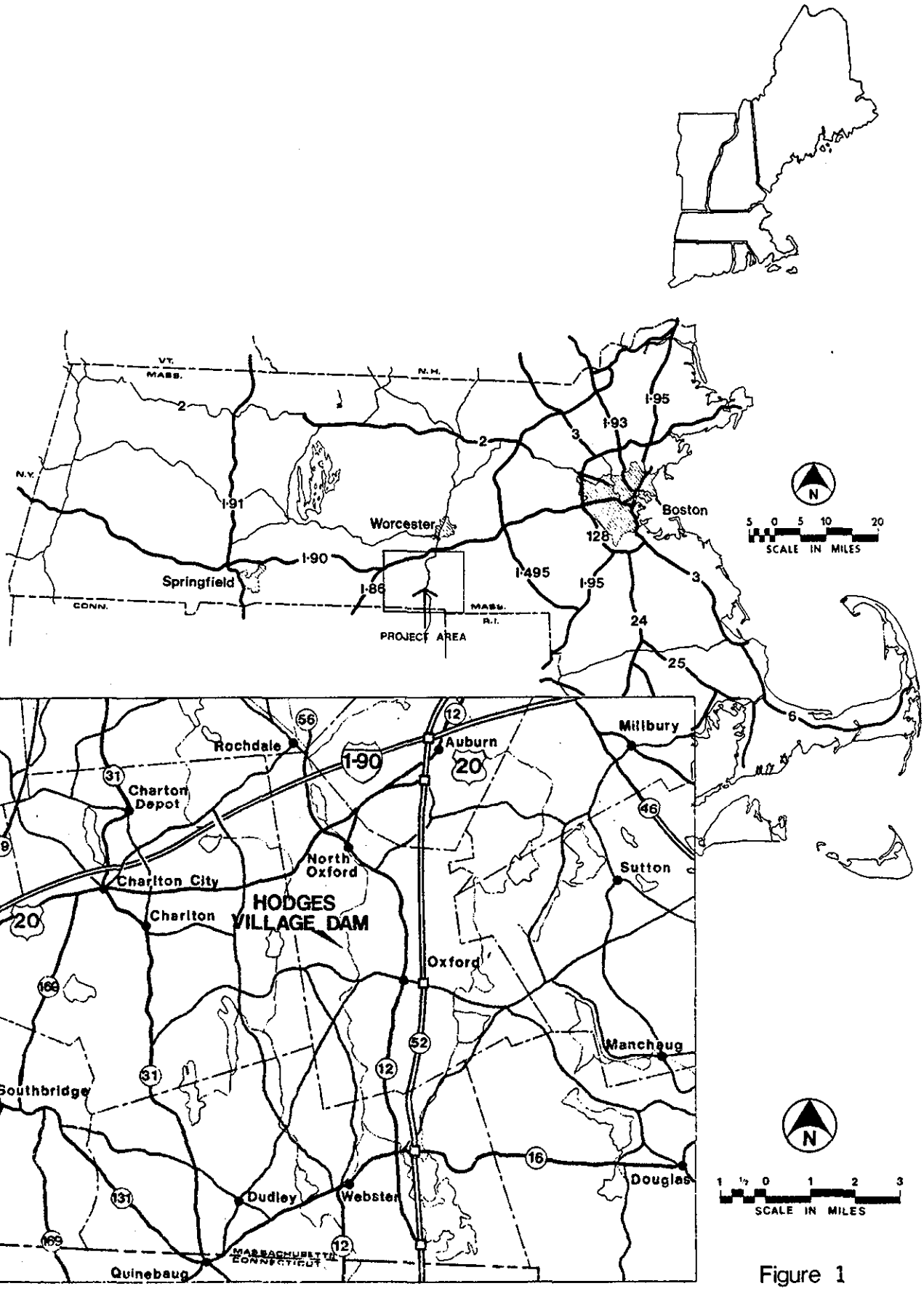
Numerous reports and results of studies, both published and unpublished were evaluated and used as support in the preparation of this report. They include reports on the existing project, those relating to the water quality of the French River and other reports concerning the Hodges Village project. A complete listing of prior reports and studies is included in the bibliography at the end of this report.

DESCRIPTION OF EXISTING PROJECT

Hodges Village Dam lies across the French River, in the town of Oxford, about 5 miles north of Webster (see Figure 1). Construction of the project was initiated in 1958 and completed in 1959.

The rolled-earthfill dam is 2,050 feet long and has a maximum height of 55 feet. Four dikes, necessary to close saddles in the reservoir perimeter, have a total length of 2,600 feet and a maximum height of 35 feet.

The reservoir is operated for flood control purposes and has a storage capacity of 13,250 acre-feet, which is equivalent to 8.0 inches of runoff from the drainage area of 31.1 square miles. The reservoir is normally empty. Control gates, located in the outlet works on bedrock under the main dam embankment, are operated to store water during times of flood. A 145-foot spillway is located off the right abutment of the dam and has its


VT.
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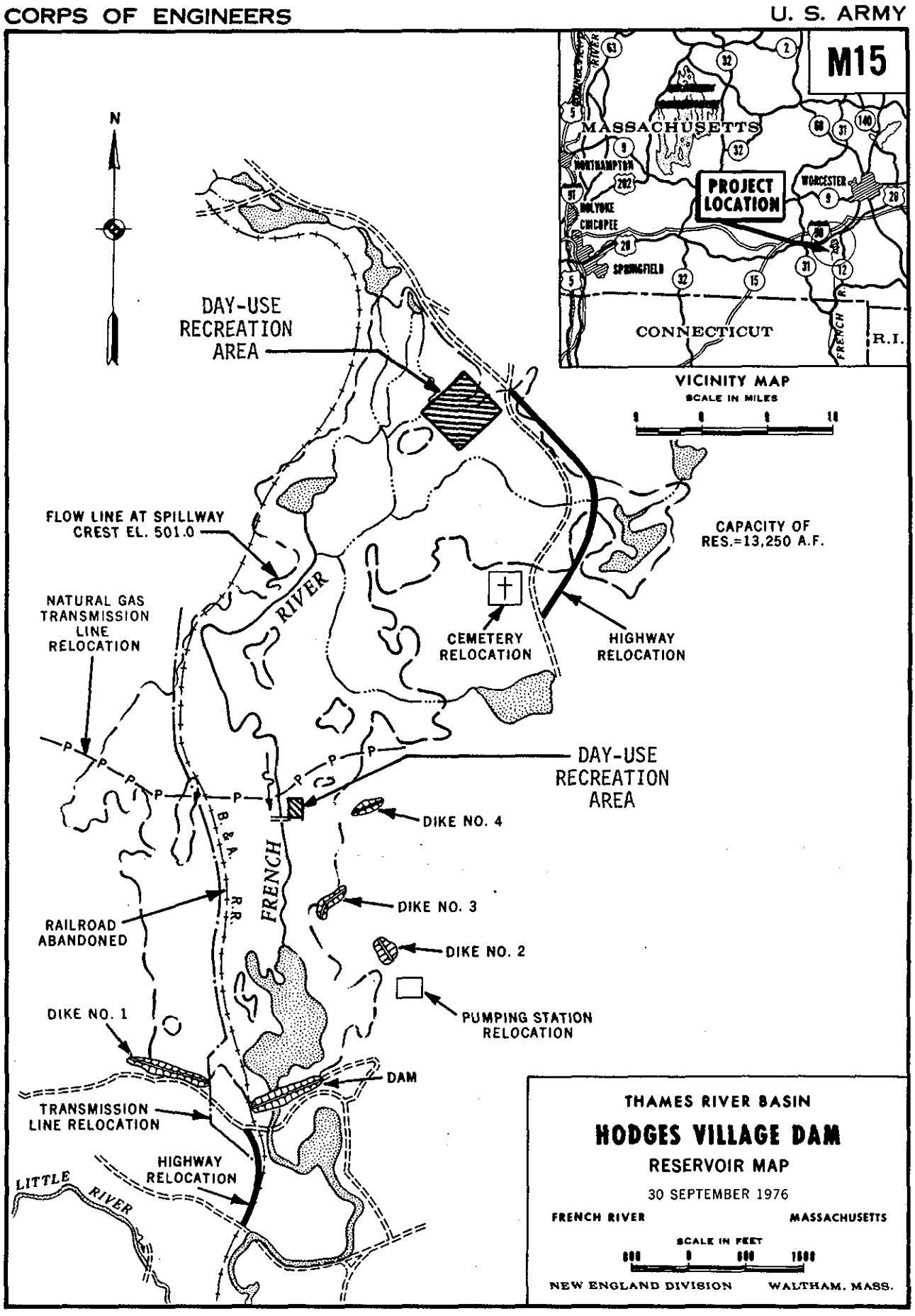
128
2
3
24
25
6
Springfield
Worcester
Boston
PROJECT AREA
SCALE IN MILES
Rochdale
Auburn
Millbury
Charton Depot
Charlton City
Charlton
North Oxford
HODGES VILLAGE DAM
Oxford
Sutton
Manchaug
Southbridge
Dudley
Webster
Douglas
Quinebaug
MASSACHUSETTS
CONNECTICUT
1-90
20
56
12
31
49
169
131
52
16
46

Figure 1

crest elevation 19 feet below the top of dam in order to protect the dam from overtopping during a maximum probable flood. If the reservoir should fill to spillway crest elevation, it would cover an area of 740 acres and extend upstream about 3 miles.

Hodges Village Dam is operated as a unit in the comprehensive plan of flood protection in the Thames River Basin. It effects major reductions in flood damages at Webster and Dudley, Massachusetts and Thompson, Connecticut. In addition, flood damages are materially reduced at damage centers extending from Putnam, Connecticut on the Quinebaug River, downstream to Norwich on the Thames River.

Public hunting and fishing in the reservoir area, insofar as consistent with applicable State laws, is encouraged. Portions of the project area are managed by the Massachusetts Division of Fisheries and Wildlife, under a lease arrangement, as a public hunting and fishing area. The town of Oxford also leases part of the project for day-use recreation activities. A plan showing the existing project is included as Figure 2.


CORPS OF ENGINEERS
U. S. ARMY
M15
MASSACHUSETTS
CONNECTICUT
R.I.
PROJECT LOCATION
NORTHAMPTON
HOLYOKE
CHICOPEE
SPRINGFIELD
WORCESTER
VICINITY MAP
SCALE IN MILES
N
DAY-USE RECREATION AREA
FLOW LINE AT SPILLWAY CREST EL. 501.0
CAPACITY OF RES.=13,250 A.F.
NATURAL GAS TRANSMISSION LINE RELOCATION
CEMETERY RELOCATION
HIGHWAY RELOCATION
DAY-USE RECREATION AREA
DIKE NO. 4
DIKE NO. 3
DIKE NO. 2
RAILROAD ABANDONED
B. & A. R.R.
FRENCH RIVER
PUMPING STATION RELOCATION
DIKE NO. 1
DAM
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LITTLE RIVER
THAMES RIVER BASIN
HODGES VILLAGE DAM
RESERVOIR MAP
30 SEPTEMBER 1976
FRENCH RIVER
MASSACHUSETTS
SCALE IN FEET
NEW ENGLAND DIVISION
WALTHAM, MASS.

Figure 2

PROBLEM IDENTIFICATION

STUDY OBJECTIVES

The planning process followed by the Corps of Engineers in its water resource studies is a systematic approach to analyzing problems and needs, identifying the desired outputs of the study and developing and evaluating alternative resource management plans. This approach is consistent with the Federal guidelines enumerated in the Water Resources Council's Principles and Standards (P & S).

Planning is directed toward achieving the objective of National Economic Development (NED). This objective is achieved by increasing the Nation's output of goods and services, and improving national economic efficiency. For this study, potential contributions to the NED objective would be derived from reduction in wastewater treatment costs and enhancement of recreational opportunities. An important element in the accomplishment of this objective is the conservation of environmental and natural resources.

EXISTING CONDITIONS

Climate and Precipitation

The French River Basin has a variable climate characterized by frequent but short periods of heavy precipitation. It is exposed to occasional

coastal storms that travel up the Atlantic seaboard. Some storms are of tropical origin and occasionally some are of hurricane intensity, heavily laden with moisture from the ocean.

The average annual air temperature of the French River Basin is about 8°C. Average monthly temperatures vary widely throughout the year, from 20 to 22°C in July and August to minus 1°C in January and February. Extremes in temperature range from occasional highs in the upper 30°C range to infrequent lows of minus 23°C or lower.

The average annual precipitation over the French River Basin is about 42 inches with highs of approximately 48 inches in the upland areas northwest of Southbridge, Massachusetts. Distribution of precipitation throughout the year is somewhat uniform. The annual snowfall over the watershed varies, with more than 50 inches in the upland areas in Massachusetts. In the early spring, water content of the snow cover seldom averages more than 2 inches in the entire basin. However, 4 inches or more has been experienced occasionally.

Stream Characteristics

The Hodges Village Project is located in the upper Thames River Basin, which extends from the Thames River tidal estuary in New London, Connecticut, northward through the eastern third of Connecticut into south central Massachusetts and western Rhode Island. The French River

joins the Quinebaug River below West Thompson Lake, near Putnam, Connecticut. The Quinebaug and Yantic Rivers join at Norwich, Connecticut, to form the tidal estuary known as the Thames River.

Hodges Village Dam spans the French River 16.5 miles above its confluence with the Quinebaug. The French River above the reservoir flows through a generally narrow valley with a narrow flood plain flanked by high, steep-sided hills. Beginning at the northern end of the reservoir at North Oxford, the valley widens and is partly lined with terraces. Much of the flood plain in this area is wetland.

Topography and Geology

The French River Valley is located in the New England upland section, near the western edge of the seaboard lowland section of the New England physiographic province. The topography of the region is of low to moderate relief with elevations generally ranging from 450 to 900 feet NGVD (National Geodetic Vertical Datum). The French River Valley is an ancient, preglacial valley which was filled with stratified glacial drift as the Pleistocene glaciers receded. The surface landforms consist of a complex of kames and kettles, kame terraces, kame plains, deltas, and a variety of other ice-contact features. Outwash plains also represent a small portion of the total deposition in the area.

The bedrock along the dam site varies from a finely-crystalline, mica schist on the area of the right abutment of the dam to a granite-gneiss along the valley bottom. The bedrock depth at the dam site varies from outcrops or near surface on the right abutment to more than 100 feet below the existing valley floor on the left side of the valley. The overburden in the vicinity of the dam consists of slightly silty sands and gravels which were deposited as outwash by the receding Pleistocene glaciers. Till generally blankets the hills and ridges except for some of the upper slopes where rock is exposed.

Vegetation

The native upland vegetation of the region generally consists of woodlands characterized as a transition from the drier oak-hickory woods of southern New England to the northern hardwood forests of beech, maple, white pine and hemlock. The transition forest is primarily a mixture of white pine and hardwoods such as maple, beech and birch. Less frequent species include ash, red oak, white oak, hickory and hemlock. Most upland woods surrounding the reservoir have a closed canopy with small to medium sized trees, indicating recent regeneration from agriculture. At present there is only limited forest management for wood production.

A large portion of the reservoir is wetland of varied plant species composition. Red maples predominate in tree swamps and are accompanied by meadowsweet, black alder, specked alder and other shrubs. Streambanks

are populated by black willow, red maple, gray birch and redosier dogwood. Marshes are dominated by cattail and tussock sedge. Shrub swamps are dominated by redosier dogwood.

Well-drained meadows contain little bluestem, asters, goldenrod, meadow-sweet, sweetfern, staghorn sumac, small white pine and quaking aspen. The reservoir area was not cleared of vegetation during dam construction, except for a 15-acre borrow area. The absence of a permanent or seasonal pool and the abundance of water tolerant plant species throughout much of the reservoir have resulted in minimal visual impact.

Wildlife

Diverse habitat types make the reservoir area suitable for a wide range of wildlife species. The marsh areas can support aquatic birds and mammals such as muskrat, vole, mice, small herons, rails and numerous wetland songbirds. The shallow waters along the French River attract surface feeders such as black duck, wood duck and mallard. Upland areas contain fox, muskrat, raccoon and rabbits, grouse, pheasant and quail. The area is annually stocked with pheasant and hare by the Massachusetts Division of Fisheries and Wildlife. The absence of a high permanent pool benefits to wildlife by allowing perpetuation of productive marshes and shrub swamps.

Water Quality

The French River in the vicinity of Hodges Village Dam is presently degraded below its approved state classification of "B" and does not meet all of the criteria associated with that standard. Data collected by the Corps of Engineers from 1975 through September 1981 and by the Massachusetts Division of Water Pollution Control (MDWPC) in June and August 1976 disclose that the standards for dissolved oxygen(DO), coliform bacteria and pH are violated periodically. In addition, concentrations of primary nutrients, nitrogen and phosphorus, are above levels considered necessary for the initiation of algae blooms. The sources of the majority of the nutrient load in the river are effluents from two upstream wastewater treatment plants, the Leicester and Oxford-Rochdale facilities. These discharges also cause the general degradation of the river's quality.

Since no pool is now maintained behind the dam, except during flood control operations, no appreciable change in downstream water quality has been noted as a result of completion and operation of the project.

Population and Housing

Historical population data from the annual town reports indicate a relatively stable population in Oxford following the industrial period of the 1800's. At the turn of the century, Oxford had approximately 3,000 residents.

All decades showed population increases, although the slowest period of growth was between 1920 and 1930. Oxford, like many northern towns, suffered population losses in the 1920's due in part to a statewide trend that saw much of the Massachusetts manufacturing industry head south for cheaper labor and less expensive raw materials.

The post-World War II "boom" produced unprecedented surges; from 1950 to 1960 Oxford's population increased by an astounding 58 percent. Veterans were building homes with FHA assistance and economic prosperity seemed to follow the routes of new and improved highways into suburban and rural areas which had not previously been tapped as sites for new homes and businesses. Since 1960, Oxford's population has continued to grow, but the rate of growth is a drastic reduction from the 1950 to 1960 period. Table 1 shows the population changes that Oxford has undergone between 1900 and 1980.

TABLE 1

Population, 1900 - 1980

Oxford, MA

Year	Population	Change	% Change
1900	2,677		
1910	3,361	684	25.6
1920	3,820	459	13.7
1930	3,943	123	3.2
1940	4,623	680	17.2
1950	5,851	1,228	26.6
1960	9,282	3,431	58.6
1970	10,345	1,063	11.5
1980	11,680	1,335	12.9

Source: U. S. Census

Housing units in Oxford in 1980 totalled 3,948. This is a 35.9 percent increase from the 1970 total of 2,905 units. Of the 1980 total, 71 percent were single family units; 22 percent of the residential structures contained 2 to 9 units. A total of 275 structures had 10 or more units.

Apartment construction made a significant contribution to the housing increases during the 1970's. The most recent large developments have been the 168-unit Thayer Village north of Route 20 and the low income Orchard Hill development of 220 units. However, single family units still predominate. The 156-units at Sherwood Forest, located on Sunset Avenue extension, is the most recent large single family development.

Economy

In its first 100 years, Oxford's chief industry was agriculture. By the early 1800's, a tannery had been constructed and sawmills had been built. Over the next 100 years Oxford became industrialized from the sale of manufactured products produced in newly built shops and mills. The small industries in Oxford produced cotton and woolen goods, shoes, harnesses, cotton thread, friction matches, pistols and rifles.

Today, Oxford's economy is still dependent on manufacturing. The decline of the textile industry in New England changed Oxford from an industrially independent town to a town dependent on a major urban core, the city of Worcester.

Data for 1979 indicates that 45 percent of employed persons in Oxford are employed in the manufacturing sector. Employment in this sector is followed by employment in the wholesale and retail trade sector and the service sector. Table 2 shows the employment by industrial sector in Oxford for both 1979 and 1967.

TABLE 2

Employment by Industry

Oxford, MA

Industry	1979 Number Employed	1979 Percent of Total	1967 Number Employed	1967 Percent of Total
Agriculture, Fisheries, Forestry	6	0.6	0	0
Mining	8	0.9	0	0
Construction	87	9.3	80	11.8
Manufacturing	415	44.6	269	39.8
Trans., Comm., Util.	12	1.3	8	1.2
Wholesale & Retail Trade	196	21.1	191	28.3
Finance, Ins. & Real Estate	24	2.6	4	0.6
Services	182	19.6	124	18.3
TOTAL	930	100.0	676	100.0

Employment in manufacturing has increased significantly, growing 54.8 percent over the 12-year period from 1967 to 1979. Services showed significant growth over this period of 46.7 percent, increasing its

proportion of the total employed from 18.3 to 19.6 percent. Wholesale and retail trade, although showing slight growth in number employed, dropped in its proportion of total employment.

Oxford lies within the Worcester Standard Metropolitan Statistical Area (SMSA) and by definition is "socially and economically integrated with the central city," Worcester. It is estimated that most residents in the cemmunity work in Worcester. Most of the people employed in Oxford, however, live in Oxford.

The unemployment rate for Oxford for September 1981 was 6.0 percent. The labor force totalled 5,165 with 309 unemployed. Oxford's rate was more favorable than the 6.3 percent rate reported for the Worcester Labor Market Area (LMA)*, which was more favorable than the State's rate of 6.5 percent. Labor force data is presented in Table 3 below.

TABLE 3

Labor Force, Employment, Unemployment

September 1981

	Labor Force	Employed	Unemployment	Unemp. Rate
Oxford	5,165	4,856	309	6.0
Worcester LMA	195,700	183,300	12,400	6.3
Massachusetts	2,950,000	2,757,000	193,000	6.5

* The LMA includes all the communities in the SMSA and Douglas and Rutland.

Land Use

A look at both 1965 and 1975 land use data for Oxford provides some insight into recent development trends. Basically, acreage for every category increased, with the exception of vacant land, which provided all the land that saw new development.

The largest percentage increases occurred in the commerical and industrial land use categories which experienced increases of 36.5 percent and 34.5 percent, respectively. The largest absolute increase occurred in the

residential category which grew by over 200 acres between 1965 and 1975. This category has continued to see large tracts of land developed as indicated in the housing section.

Land use data for 1965 and 1975 are presented in Table 4.

TABLE 4

Land Use, 1965-1975

Oxford, MA

Total Acres - 17,529.60

Uses	1965 Acres	1975 Acres	% of Change
Agriculture	266.12	296.37	11.4
Open Space	782.22	853.75	9.2
Recreation	93.97	111.50	18.7
Residential	879.26	1,085.43	23.4
Single Family	783.13	971.28	24.0
Two & Three Family	89.05	93.84	5.4
Multi Family	7.08	20.31	186.9
Industrial	267.90	360.39	34.5
Commercial	61.00	83.26	36.5
Institutional	665.11	808.16	21.5
Water	507.85	513.03	1.0
Total Use	3,523.43	4,111.89	16.7
Vacant	14,006.17	13,417.71	- 4.2

Reservoir Land Use

Since construction of the dam, the major use of reservoir land has been for recreation purposes. Although reservoir flood control operations, wet soils and steep slopes tend to limit extensive recreation development, activities such as fishing, hunting, hiking, snowmobiling and passive recreation pursuits are common.

The area owned by the Corps of Engineers totals 871 acres. Of this fee-owned area, two recreation areas totalling 109 acres are leased to the town of Oxford. Activities within these areas, the Greenbriar and Rocky Hill Recreation Areas, include baseball, tennis, skating and picnicking. The Commonwealth of Massachusetts Division of Fisheries and Wildlife has a license to utilize 676 acres of these project lands under a General Plan for Fish and Wildlife Management. The remaining 86 acres are reserved for project operation and maintenance. In addition to the areas owned in fee, the Corps also has flowage easements over 264 acres. Development of all areas owned in fee or covered by flowage easements is prohibited except for those structures or other improvements that are approved and are able to sustain periodic inundation.

The privately owned land adjacent to Hodges Village Reservoir on the west is gradually being developed from woodland to residential use, in addition to the extensive Scavone Sand and Gravel Company excavation operations. The east side of the reservoir is partially bordered by Route 12, which

passes through the center of Oxford. Private residences, the Oxford High School, the North and St. Roche Cemeteries, the Oxford Water Pumping Station and a town gravel pit are all located between the reservoir and Route 12.

Cultural Setting

Prehistoric occupation of central Massachusetts dates from the late post-glacial period (c. 10,000 BC) to the time of European contact in the early 17th century. Most settlement during this period was probably seasonal in nature, with small camps sited along the French River at the edges of wetlands. Agriculture began to be practiced in the region toward the end of the period (c. 1,000 AD), and larger settlements may have been present in the flood plain by that time.

Recorded prehistoric sites exist in the vicinity of Buffum Pond and Buffumville Reservoir, west of Hodges Village Dam. Detailed data on these sites are lacking, but at least one appears to have been located near a deep fishing hole on the brook. They probably represent camping sites repeatedly visited over a number of seasons.

Historic period occupation in Oxford began with the settlement of 52 Huguenot families in 1686. The traditional site of one of their fortified villages was near the present Oxford center. This settlement was abandoned following Indian raids in 1694 and 1696. Resettlement, by 30 Anglo-Europeans, did not occur until 1713.

Eighteenth century Oxford appears to have been a typical farming community, with a few grist and sawmills. During the 19th century a number of textile mills were built in the community, including one south of Hodges Village Dam and another near the project's northern end. Most settlement in the project vicinity continued to consist of detached farms. The railbed through the project area was also constructed in the early 19th century. Oxford began to function as a suburb of Worcester during the 20th century, and several new detatched homes and subdivision developments were built within the project area during this time.

There are no recorded prehistoric sites within the Hodges Village Dam project area, but a high potential for presence of unrecorded sites is indicated in undisturbed areas near wetland margins. The project contains 19 recorded historic sites or structures dating from between 1713 and 1898. Fourteen are dwelling sites with outbuildings, two are bridge locations, two are mill sites, and one is the early 19th century railbed paralleling the west bank of the river.

THE WITHOUT CONDITION

This section describes the most probable future conditions if no modifications are undertaken at the Hodges Village project. Proposed modifications are assessed and evaluated by comparing the "with" to the "without modification" conditions.

Future Population

Population projections prepared by the Central Massachusetts Regional Planning Commission indicate Oxford's population will be 12,925 by the year 2000. Projections for 5-year increments to 2000 are presented below:

1985	12,100
1990	12,350
1995	12,725
2000	12,925

This projected growth to 2000 is a 10.7 percent increase from the 1980 population of 11,680.

Future Growth

The town of Oxford has been making efforts to strengthen the economic base. It has adopted two strategies for accomplishing this: one is attracting new industry and jobs, and the other is encouraging local employers to expand. Generally, it is felt that the town needs to be more aggressive in promoting an image favorable for industry location. With the completion of Route 52, the prospect for industrial growth should be quite favorable.

Oxford has increasingly become a bedroom suburb of Worcester and is expected to continue growing in such a manner. Very little commercial growth can be foreseen in the future. Any commercial growth that is likely to occur would probably take place along Route 20 or south of Oxford center along or just off Route 12.

Future Water Quality Condition

It is expected that water quality conditions in the French River above Hodges Village Dam will be significantly improved by 1983 with the implementation of new management plans for the upstream watershed. Current plans call for the upgrading of the Leicester wastewater treatment plant to advanced secondary treatment by adding spray application of the effluent to land upstream from Sargent Pond, which is in the headwaters of the French River. The Oxford-Rochdale plant treatment processes will not be changed. Some unsewered areas that were to be tied into the Oxford-Rochdale plant will be tied into the Leicester plant instead. The Massachusetts Division of Water Pollution Control (MDWPC) expects these actions will remove the major nutrient sources from areas upstream from the project, and that nitrogen and phosphorus loads will then decline to near background levels that are below threshold levels needed for algae bloom propagation. However, in the reach of the French River below Webster and Dudley, the EPA and MDWPC expect water quality conditions to remain below adopted State standards even after the implementation of the upstream watershed's new management plan and planned upgradings of the treatment plants at Webster and Dudley.

PROBLEMS AND OPPORTUNITIES

The problems and opportunities presented in this section were identified through interaction with the public and other agencies. They are not to be considered all-inclusive of the problems and opportunities that exist in the study area as others may emerge as the study progresses.

Flooding

As stated earlier in this report, the existing project is a single purpose flood control dam which has a storage capacity equivalent to 8.0 inches of runoff from its contributing drainage area of 31.1 square miles. Since its completion in 1959, the project has been instrumental in reducing flood damages in downstream areas. Flood damages prevented through September 1981, amount to $11,520,000.

Operation of the reservoir is conducted by the New England Division under the direction of the Reservoir Control Center (RCC). During normal (non-flood) periods, the reservoir is kept empty. In the event of imminent flooding, the dam is operated to provide downstream protection with the reservoir being emptied as rapidly as safely possible after the flood event. Since completion of the project, there have been no difficulties associated with flood control operations and there is no present need to increase the flood control capacity of the reservoir.

Water Supply

The adequacy of existing water supplies in the Thames River Basin was assessed in a report, "Thames River Basin Overview," completed by the New England River Basins Commission in June, 1979. This report found that water supplies within the basin are plentiful and that any problems with public supply are minimal and localized. In the Massachusetts portion of the basin, public suppliers serve approximately 72 percent of the population. The majority of communities in the vicinity of the Hodges Village project, including Oxford, Dudley and Webster, draw their supplies from groundwater sources, while Leicester has both surface and groundwater supplies. These supplies are projected to be ample through 1990 without need to develop new sources. Consequently, there is no present need to develop additional water supply sources in the vicinity of the project.

Hydropower

Due to the increased importance of developing hydropower at all feasible sites, a preliminary evaluation of the hydropower potential at Hodges Village Dam was performed. Two important assumptions were made for this analysis. The first was that a portion of the existing flood control storage would be allocated to hydropower. However, since significant encroachment on flood control cannot be permitted, the amount of storage allocated to hydropower was limited to 12.5 percent of the total storage capacity of the reservoir. This resulted in a net power head of 14

feet. Secondly, the powerhouse was assumed to be located relatively close to the base of the dam, which eliminates the need for a penstock. An efficiency of 80 percent was used in the analysis.

The results of the analysis indicated that a hydropower project with the lowest cost per unit of electricity producted would have an installed capacity in the range of 50 to 75 kilowatts (kW). The average annual energy generated in this range would be about 270,000 kilowatt-hours (kwh). The cost of producing this energy would be about $0.35 per kwh. Based on power values received from the Federal Energy Regulatory Commission, which indicate that the maximum expected return from an installation such as this in New England is about $0.14 per kwh, hydropower development would not be economically feasible.

Recreation

Oxford's Planning Board has identified a number of specific needs for additional recreational facilities and programs. The board has suggested the formation of several recreation programs, including swimming, tennis hiking, cross-country skiing, camping, bicycling, snowmobiling, and skating programs. The board also suggested that the town look into the establishment of a recreation center in Oxford.

A master plan prepared by the Corps recommends recreational development for the Hodges Village Reservoir area, which is compatible with several of Oxford's expressed needs. Facilities proposed for the Greenbriar Recreation Area include soccer and softball fields, a playground, and tennis and basketball courts. Because of Oxford's supervision and management problems in the Rocky Hill Recreation Area, no new facilities have been proposed for this area.

Low Augmentation

The need for low flow augmentation at the Hodges Village project is a direct result of the existing and projected future water quality conditions of the French River. Although planned improvements in wastewater treatment are expected to result in acceptable water quality for much of the French River, conditions below Webster and Dudley, Massachusetts, are expected to remain below adopted State standards. Consequently, the EPA and the Massachusetts Division of Water Pollution Control (MDWPC) have recommended that the Corps undertake a study to determine the feasibility of providing seasonal low flow augmentation storage at the Hodges Village project. Low flow augmentation in combination with advanced treatment would result in a significant improvement in the water quality of the French River. To provide sufficient water quality enhancement, the EPA and MDWPC currently recommend that a minimum flow rate of 22 cfs be maintained at the USGS gaging station on the French River in Webster, Massachusetts.

Condition of Existing Project

Periodic Inspection Reports were prepared on the existing project in May 1976 and July 1980. These reports determined that the dam and appurtenant features are in good condition and that there are no major problems which would hamper the operation of the dam during flood emergencies. However, seepage has been observed at the downstream toe of the dam in the old river channel, primarily during flood control operations. The flow is clear and there is no evidence of internal erosion (piping) of embankment material. A temporary, wooden V-notch weir was installed downstream from the dam in 1977 to measure seepage versus pool stage. Weir readings to date include those for pool stages up to 22 feet, and there is no indication that these seepage conditions affect the integrity of the dam embankment.

The most recent inspection report recommended that a concrete weir be installed to replace the deteriorating plywood weir. Seepage conditions should also be monitored by recording weir readings along with pool stages whenever the pool stage exceeds 8 feet.

PLANNING CONSTRAINTS

During the course of the study, several significant items that placed limitations on the plan formulation process were identified. The first is the General Plan for Fish and Wildlife Management covering the project.

Under this plan, 676 acres of land and water areas have been made available to the Massachusetts Division of Fish and Wildlife for purposes of conserving, managing and developing fish and wildlife resources. All proposals will continue to be evaluated for their impact on this agreement and fish and wildlife resources.

Another constraint on additional development at the project would be the amount of reservoir storage that could be utilized for other purposes. Since the primary purpose of the project is flood control, a significant reduction in its capability to reduce flood damages would not be permitted.

A third planning constraint concerns seepage through the dam embankment during flood control operations. Although there is no indication that this seepage affects the integrity of the dam, seepage studies will be accomplished for proposals that involve the creation of a seasonal or permanent pool behind the dam.

The final constraint relates to existing recreational facilities. The town now leases 109 acres of reservoir area and has indicated a need for additional park type facilities. The impact of various proposals on recreation will continue to be coordinated with local officials to assist in mitigating any adverse impacts.

SUMMARY OF PROBLEMS AND OPPORTUNITIES

Based upon the assessment of existing and projected future conditions, the most serious problems in the study area are the water quality of the French River and the need for additional recreation facilities in Oxford. Consequently, the primary goals of this study are to assist in improving the future water quality of the French River by augmenting flows downstream of the dam and providing additional recreation opportunities at the project. The following section discusses alternative methods of satisfying these needs within the constraints previously identified.

FORMULATION OF ALTERNATIVE PLANS

Inasmuch as alternative methods of improving the water quality of the French River were studied primarily by others, most notably the EPA and the Massachusetts Division of Water Pollution Control (MDWPC), this section will summarize their findings as they pertain to involvement by the Corps of Engineers. Providing additional recreational opportunities within the project area will also be addressed.

Currently underway is a combined Federal/State effort to restore fishable, swimmable water quality (Class B) in the French River in Massachusetts and Connecticut. At the present time Class B water quality standards are not met in the French River due to municipal and industrial wastewater discharges compounded by years of sediment buildup at several impoundments in both States. The high cost of attaining standards solely through treatment of discharges from Webster and Dudley has led the towns, the States and EPA to search for less costly alternative solutions. In this regard, the towns have hired a consultant to investigate all possible treatment alternatives while Massachusetts and Connecticut are examining ways of dealing with instream sludge deposits at instream impoundments. At the same time, the Corps initiated this study to determine the feasibility of providing storage for low flow augmentation at Hodges Village Dam.

As required by Federal regulations, reuse, land treatment, and treatment and discharge alternatives were considered as part of facilities planning. The study determined that no reuse or land treatment opportunities exist within the towns of Webster and Dudley. In evaluating land treatment, slow rate and rapid infiltration, overland flow, silviculture and wetland application were all considered. Overland flow and silviculture were not feasible because suitable soils and/or vegetation are not available. Wetland systems operated in the United States have not been found capable of achieving the high degree of treatment required and they were eliminated from further consideration. An evaluation of utilizing slow rate and rapid infiltration methods determined that due to soil types, topography, required buffer zones and other limitations, no potential sites could be found in Webster and less than 200 acres of suitable land could be found in Dudley. Inasmuch as the land required for either slow rate or rapid infiltration would exceed that available, neither of these land treatment alternatives was considered feasible for treatment of discharges from Webster and Dudley. For these reasons, studies focused on finding a method of treating the wastewaters of the towns so that they may be discharged into the French River.

During studies to date, all potential treatment and discharge options were reviewed, considering the capabilities of existing facilities. Because the towns have a considerable investment in their existing wastewater treatment plants, studies were aimed at determining treatment methods that would make maximum use of these plants.

As a first step in that investigation, various regional options were reviewed considering whether the towns should continue to treat their wastes separately or should treat them jointly. The options considered include the following:

1. Provision of advanced wastewater treatment (AWT) at separate treatment plants located in Webster and Dudley.

2. Provision of secondary treatment of Dudley wastewater at its existing treatment plant, followed by AWT at the Webster treatment plant.

3. Provision of something less than secondary treatment (roughing) of Dudley wastewater at its existing plant, followed by AWT at the Webster treatment plant.

4. Provision of all treatment at an AWT facility in Webster.

Construction of a single AWT plant in Dudley to handle the wastes of both towns was not considered due to the large existing facility in Webster.

Based on a cost analysis of these four options, it was recommended that only the last two possibilities be evaluated further. The present worth costs of options one and two were estimated to be 25 and 15 percent higher, respectively, than those of options three and four. The

preliminary costs for options three and four were essentially equal. However, when the existing, relatively new facility at Dudley is considered, option three (roughing at Dudley followed by AWT at Webster) was selected as the preferred alternative. Cost estimates for option three were developed assuming two conditions: low flow augmentation storage can be provided at Hodges Village dam, and low flow augmentation storage cannot be provided.

Model studies conducted by the Massachusetts Division of Water Pollution Control and EPA indicate that if low flow augmentation is utilized in conjunction with AWT, a minimum flow of 22 cfs is required at the Webster gage to meet water quality standards below the Webster and Dudley treatment plants. Furthermore, the water used for augmentation must be of fairly good quality, having a BOD_5 (5-day biochemical oxygen demand) lower than 3.0 mg/l and a D.O. (dissolved oxygen level) of at least 6.0 mg/l. A preliminary comparison of effluent limits and treatment costs with and without low flow augmentation for option 3 is presented on Table 5.

TABLE 5

COMPARISON OF EFFLUENT LIMITS AND TREATMENT COSTS

WITH AND WITHOUT LOW FLOW AUGMENTATION

	Without Low Flow Augmentation	With Low Flow Augmentation
Webster/Dudley Wastewater Flow, mgd (cfs)	6(9)	6(9)
Webster gage flow (7-Q-10, cfs[1])	11	22
Webster effluent characteristics, mg/l		
BOD_5	5	10
NH_3	1	2
P	1	1
D.O.	6	6

Costs (in $1,000,000 units)

Capital cost, Present Worth	$13.0	$ 7.2
O & M cost, Present Worth	14.6	10.3
Total Present Worth	27.6	17.5
Total Annual Cost @ 7-5/8% for 20 years	2.54	1.61

Difference in Annual Cost $930,000

[1]Average 7-day low flow for a 10-year event.

As shown on this table, with a continuous minimum flow of 22 cfs maintained at the USGS gage in Webster, the projected annual savings in wastewater treatment cost is approximately $930,000.

Based on the results of the aforementioned studies, EPA has endorsed low flow augmentation as one element in an overall plan to improve the water quality of the French River. Inasmuch as other elements of the overall plan will be addressed by others, the remainder of this issue resolution report will describe, assess and evaluate a plan to modify the Hodges Village Dam to provide a flow of 22 cfs at the USGS gage in Webster. The possibility of expanding recreation facilities at the Greenbrier Recreation Area or adding recreational opportunities at other sites within the project area will be investigated as part of this plan.

DESCRIPTION, ASSESSMENT AND EVALUATION OF LOW FLOW AUGMENTATION PLAN

Based on the analysis discussed in the previous section, which indicates that further study of this element of the overall water quality improvement plan is warranted, providing storage for low flow augmentation at Hodges Village Dam was selected for more detailed investigation. This plan has the capability of either solving or contributing to the solution of the water quality and other problems that have been identified in the study area.

PLAN DESCRIPTION

The plan under consideration consists of the creation of a 200-acre seasonal impoundment at Hodges Village Dam and Reservoir to maintain a flow of not less than 22 cfs (about 10,000 gallons per minute) at the French River stream gage in Webster from June to October. An analysis of the discharge records at Webster and Hodges Village Dam indicates that with 0.3 inch of reservoir storage available for flow augmentation, this streamflow requirement would be met with a reliability in excess of 9 out of 10 days between 1 June through 31 October. The following tabulation outlines reservoir data associated with maintaining 22 cfs at the Webster USGS gage.

Pool Stage (feet)	10.1
Pool Elevation (feet NGVD)	475.6
Pool Area (acres)	200
Storage (acre-feet)	700
Storage (inches runoff)	0.42
Pool Evaporation losses (inches runoff)	0.10
Begin Buildup of Hodges Village Pool	1 May

In conjunction with providing seasonal storage for low flow augmentation, a small permanent pool would also be maintained for aesthetics. The permanent pool would be at about elevation 472 (stage of 6.5 feet) and have an area of 90 acres and storage of about 190 acre-feet, which is equivalent to about 0.1 inch of runoff.

During the augmentation season, the pool elevations shown on Table 6 will be adhered to as closely as possible. This will insure that sufficient storage is maintained to allow flow augmentation throughout the season. Future hydrologic studies associated with daily reservoir regulation procedures may, however, result in slightly modified pool levels.

TABLE 6

22 cfs Low Flow Augmentation

Pool Elevations

Date	Maximum (ft., NGVD)	Minimum (ft., NGVD)
31 May	475.6	475.6
30 June	475.5	475.5
31 July	474.8	474.6
31 August	474.2	473.7
30 September	472.3	472.1
31 October	472.0	472.0

As previously stated, the quality of water used for augmentation must be good, having a BOD_5 lower than 3.0 mg/l and a D.O. of at least 6.0 mg/l. Since these standards must be met, the degree to which the reservoir site must be prepared prior to inundation was investigated. To determine the sort of preparation required, nine soil-water contact columns were set up and studied. This analysis determined that approximately 160 acres of the 200 acres to be inundated would require preparation. The degree of preparation was either clearing and grubbing; or clearing, grubbing and the stripping of loam and forest floor debris down to mineral soil. These areas are shown on Plate 1. It is currently estimated that 615,000 cubic yards of organic soils need to be stripped in selected areas.

To provide finer control of outflows from the dam, modification of the outlet works would be necessary. The proposed work includes the addition of a piggyback gate on one of the two existing 6-foot high by 5-foot wide gates and construction of an approach weir upstream of one of the gates.

To ensure the future integrity of the dam with the proposed seasonal and small permanent pool, seepage control measures are also proposed for the downstream toe of the dam. These measures are shown on Plate 2.

ECONOMICS

As shown on Table 7, the total estimated first cost of the project elements outlined above is $3.2 million. This cost, which reflects February 1982 price levels, includes a 20 percent contingency factor and costs for engineering and design and supervision and administration.

TABLE 7

PRELIMINARY FIRST COSTS

LOW FLOW AUGMENTATION PLAN

Item	Quantity	Unit	Unit Price	Amount
Clearing	1	Job	L.S.	$ 265,000
Stripping	615,000	C.Y.	3.00	1,845,000
Excavation	600	C.Y.	5.00	3,000
Sand and Gravel Filter	250	C.Y.	10.00	2,500
Rock Fill	400	C.Y.	25.00	10,000
Random Fill	1,900	C.Y.	3.00	5,700
6" Topsoil Seeded	2,100	S.Y.	3.00	6,300
Reinforced Concrete	11	C.Y.	200.00	2,200
Piggy-Back Gate	1	Job	L.S.	30,000
Approach Weir	1	Job	L.S.	30,000
			SUBTOTAL	$2,199,700
			Contingency (20%)	450,300
			TOTAL CONSTRUCTION COSTS	$2,650,000
			Engineering and Design	320,000*
			Supervision and Administration	230,000
			TOTAL ESTIMATED FIRST COSTS	$3,200,000

*Does not include preauthorization costs.

The benefits derived by this plan are those associated with treatment cost savings. The EPA has stated that without low flow augmentation the level of treatment must be increased to two-stage nitrification (rather than single stage) and the operation and maintenance must be increased to account for additional power and labor to reduce the ammonia concentration from 2 mg/1 to 1 mg/1. A more flexible and expensive phosphorus removal system must also be included. The costs related to this increase in treatment level were annualized to determine the annual treatment cost savings. Annual treatment cost savings amount to $930,000 and are based on May 1981 price levels. The costs and benefits of this plan are itemized below:

Comparison of Costs and Benefits

Costs

First Cost *	$ 3,200,000
Annual Cost **	$ 316,900

Benefits

Annual Treatment Cost Savings	$ 930,000

BCR 2.9 to 1

* These costs are 100 percent Federal

** Annual costs were amortized over a 20-year period at a 7-5/8 percent interest rate to be comparable to the EPA's presentation of annual treatment cost savings.

IMPACTS

There are both short and long term effects associated with the inclusion of low flow augmentation storage at the Hodges Village Dam. Short term effects would occur during the clearing, grubbing, and stripping operation. The area to be inundated by the seasonal pool totals approximately 200 acres. The material from stripping would be trucked to a disposal

site that would be specified during advanced design. This activity would increase local noise and dust levels and increase the number of trucks and construction equipment moving in the study area. These effects are not thought to be significant since the area is relatively isolated. Impacts could be significant if the disposal site were in a residential or intensively used area. The project would also include some minor engineering modifications to the existing structure, which would be another source of minor impacts. This activity is expected to be accomplished during one construction season. Consequently some interference with recreational activities could be anticipated between March and November.

Long term effects generally appear in the conditions that prevail once construction of a project has been completed. Within the immediate area surrounding the project, long term effects fall in the areas of vegetation, wildlife, recreation, aesthetics and institutional arrangements.

The clearing and grubbing of vegetation and stripping of some organic soil within the proposed pool area would impact an area consisting primarily of seasonally wet meadowland and shrub swamp. Work within this area would impact between 15 and 20 percent of the 676 acres currently under license to the Massachusetts Division of Fisheries and Wildlife for management as wildlife habitat. This area is licensed under the General Plan for Fish and Wildlife Management. The study will continue to be coordinated with the Massachusetts Division of Fisheries and Wildlife and the U.S. Fish and Wildlife Service to discuss the relationship of the General Plan to the proposed pool.

The proposed pool at its maximum level would impact small portions of both the Greenbriar and Rocky Hill Recreation Areas, which are leased to the town of Oxford. Loss of these sections would not directly affect recreational facilities developed to date. A section of Old Howarth Road, however, would have to be closed when the pool is at its highest stages, restricting summer trail access along the east side of the French River. Since much of the reservoir area is used by hikers, cross-country skiers, hunters and fishermen, the presence of a pool would tend to restrict these activities.

The removal of vegetation, together with a seasonally fluctuating pool, would create long term visual impacts. This impact would be measureable from viewpoints within the project area and along a section of Route 12. The visual impacts would be partially mitigated by creation of a 90-acre, permanent, aesthetic pool and also during the early summer when the augmentation pool is at its maximum elevation. However, as the pool is drawn down, the relatively flat topography of the reservoir would result in exposure of cleared peripheral areas.

The major effect outside the project area would be the improvement of water quality downstream of Hodges Village Dam. By providing releases of good quality water, the project would help in eliminating water quality violations that occur in the French River below Dudley and Webster during high temperature and low streamflow periods. With improvement in flow characteristics, downstream fisheries may benefit by improvement in

habitat. Improvement in water quality may also result in an increase in the use of downstream areas for recreational activities, such as fishing.

It appears unlikely that historic period sites would be affected by the low flow augmentation project, as all recorded structures except the two bridge sites are above the maximum stripping and grubbing zones. However, historic period dumps or complete earlier unrecorded sites may be in the impact zone. Prehistoric sites may well exist on dry ground at the edges of the impact zone, and could be damaged by stripping or grubbing.

For the above reasons, an archaeological reconnaissance survey will be performed as part of further planning efforts to locate a sample of archaeological resources in the impact zone. If such resources are located, a more intensive survey of high potential areas identified in the reconnaissance will be undertaken during advanced design. For any identified sites, this would include an assessment of eligibility for the National Register of Historic Places and development of mitigation plans as needed.

PUBLIC INVOLVEMENT

Meetings have been held with Oxford town officials to inform them of the need for the project and related potential impacts. The officials

indicated concern for the impact that the clearing and stripping may have on the aesthetics and recreation resources of the reservoir. They also expressed their desire to obtain some benefit in the form of recreation facilities to offset the impact of the project.

In February 1982, a project information brochure was prepared and distributed to local interests' (copy attached as Inclosure 2). The purpose of this brochure was to assist local officials and concerned citizens in achieving a better understanding of the Corps' role in the Federal and State effort to improve the water quality of the French River.

The study has also been closely coordinated with other interested Federal, State and local interests. One of the primary means of coordination has been through the State-EPA Agreement (SEA) Working Group, which replaced the French River Task Force in 1979. The objective of this group is to insure that coordinated pollution control and abatement efforts occur between Massachusetts and Connecticut. The group is composed of EPA, as lead agency, the states of Massachusetts and Connecticut, the Corps of Engineers, and the New England Interstate Water Pollution Control Commission. Representatives from the towns of Webster, Dudley and Oxford have also taken part in the meetings, which are held on a quarterly basis to exchange and discuss technical information and the status of studies in progress.

INSTITUTIONAL CONCERNS

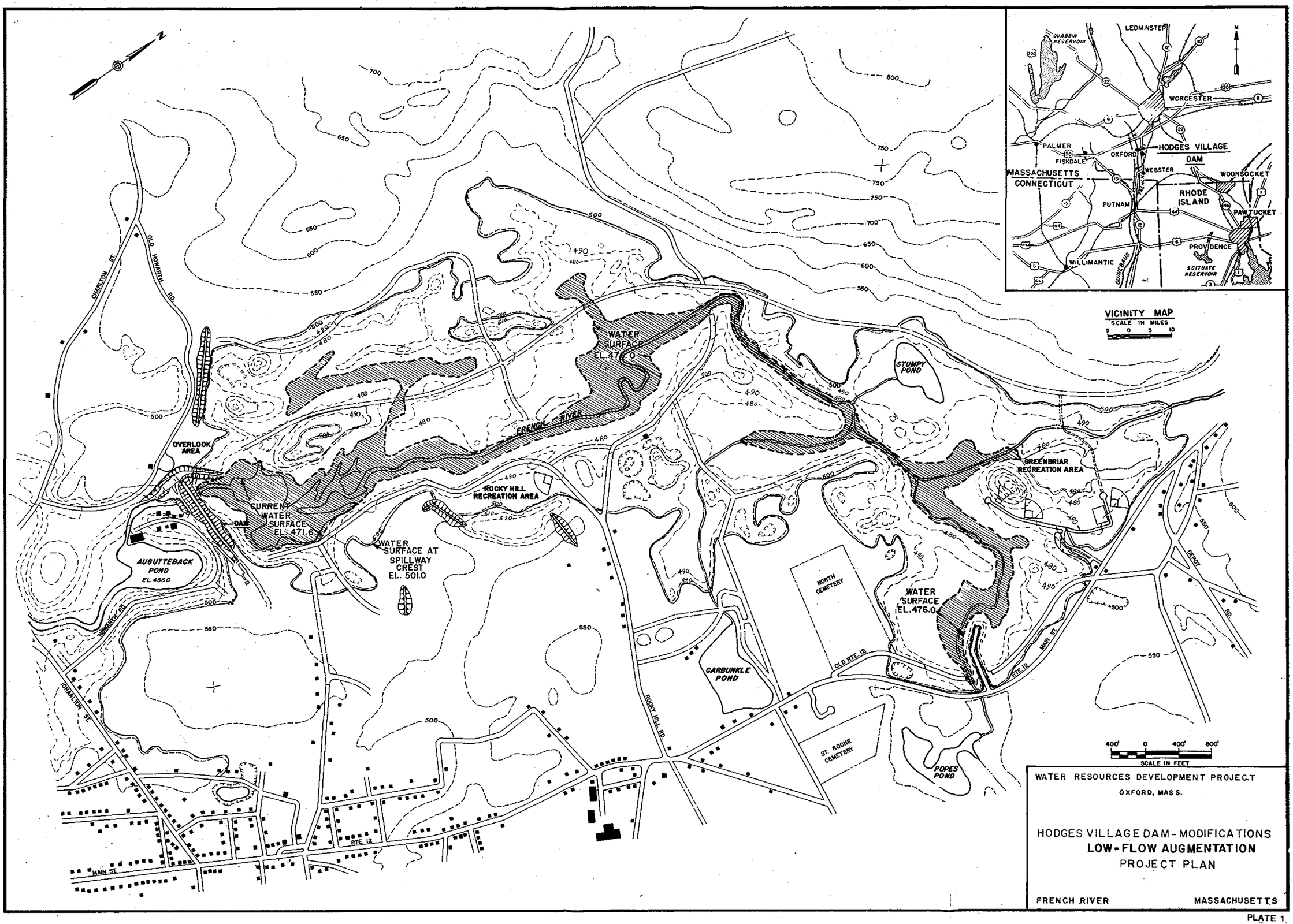
These investigations are concerned with mitigating negative impacts on recreation activities within the reservoir. Massachusetts officials have indicated that under Chapter 21, funds are authorized for the modification of reservoirs to provide low flow augmentation. It is their opinion that these funds may be utilized as the non-Federal share in the cost of new recreational facilities. It is therefore anticipated that the Corps and the Commonwealth of Massachusetts may share the cost of providing the town of Oxford with additional recreational facilities. Although the recreational facilities proposed in the most recent Master Plan appear warranted, further studies will be accomplished to refine current recreation needs. Based on the needs, plans and cost estimates will be developed and evaluated for economic justification. If these recreational improvements are justified, their cost will then be added to the cost of the low flow augmentation plan.

CONCLUSIONS AND RECOMMENDATIONS

All investigations to this point emphasize the need for low flow augmentation in the French River. The study has shown that providing storage for low flow augmentation from Hodges Village Dam and Reservoir is technically and economically feasible. Support for such a plan has been exhibited by EPA, Massachusetts Division of Water Pollution Control (MCWPC), and Congressional interests. There is sufficient reason to continue this study to completion.

Studies by the Corps, EPA and MDWPC indicate that the plan to augment flows to provide a minimum of 22 cfs at Webster would satisfy all objectives of the study. The EPA and MDWPC have determined from their investigations that a flow greater than 22 cfs is not required to meet water quality requirements nor would it provide any additional benefits related to treatment cost savings.

It is recommended that the plan to augment flows to provide a minimum of 22 cfs at the gage in Webster be designated as the selected plan to be investigated in more detail in the next stage of the study. Major studies to be conducted in the final stage of the investigation included refining the proposed plan by conducting additional engineering and economic studies, assessing the possibility of providing additional recreation facilities in conjunction with the modification and preparing an EIS. Any cost-sharing arrangements and other local cooperation agreements will be finalized at that time.



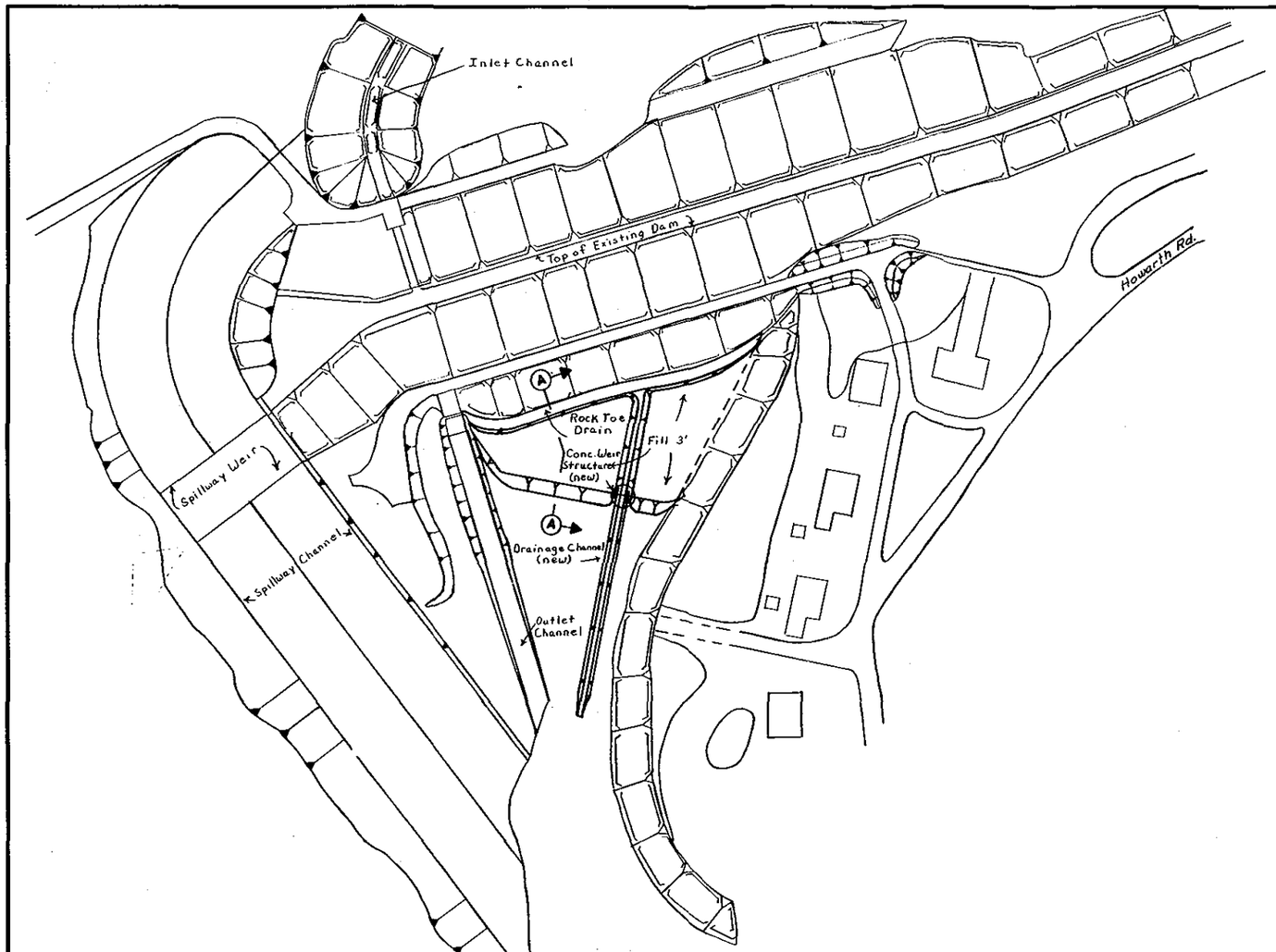
WATER RESOURCES DEVELOPMENT PROJECT

OXFORD, MASS.

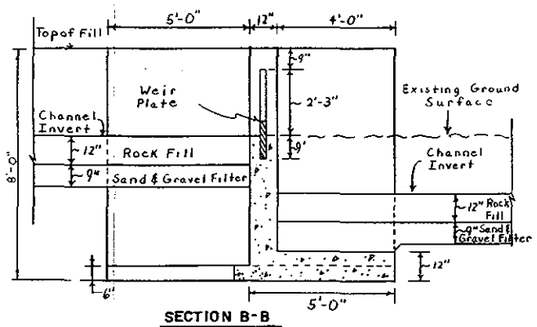
HODGES VILLAGE DAM - MODIFICATIONS
LOW-FLOW AUGMENTATION
PROJECT PLAN

FRENCH RIVER — MASSACHUSETTS

PLATE 1



SITE PLAN
SCALE: 1" = 50'



SECTION B-B
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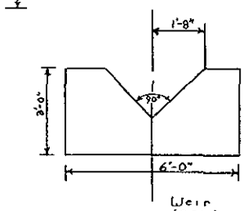
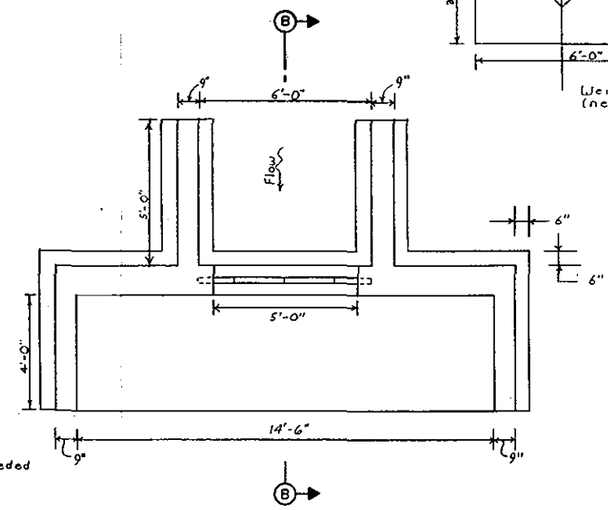
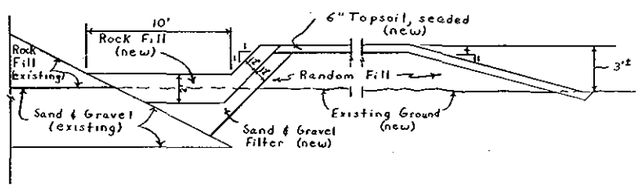




PLAN

CONCRETE WEIR STRUCTURE
SCALE: 1"=2'



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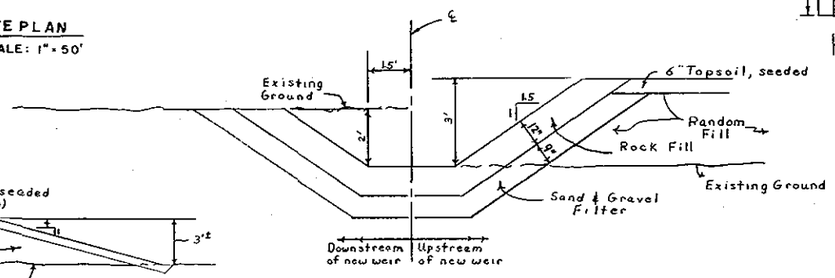

TYPICAL CHANNEL SECTION
SCALE: 1" = 2'

1"=50' 50' 0 50' 100'
1"=4' 4' 0 4' 8'
1"=2' 2' 0 2' 4'

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES DEVELOPMENT PROJECT
OXFORD, MASS.

HODGES VILLAGE DAM MODIFICATIONS LOW FLOW AUMENTATION

PLANS AND SECTIONS

FRENCH RIVER MASSACHUSETTS

PLATE 2

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INCLOSURES TO DOCUMENTATION FOR ISSUE RESOLUTION

1. TECHNICAL DATA
2. PROJECT INFORMATION BROCHURE
3. PERTINENT CORRESPONDENCE
4. OUTLINE AND SCHEDULE OF WORK

INCLOSURE 1

A. WATER QUALITY CONTROL

B. HYDROLOGY

C. GEOTECHNICAL CONSIDERATIONS

D. PERTINENT DATA

A. WATER QUALITY CONTROL

WATER QUALITY CONTROL
HODGES VILLAGE DAM AND RESERVOIR
LOW FLOW AUGMENTATION STUDY

PREPARED BY
THE
HYDRAULICS AND WATER QUALITY SECTION
WATER CONTROL BRANCH
ENGINEERING DIVISION

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

FEBRUARY 1982

WATER QUALITY CONTROL
HODGES VILLAGE DAM AND RESERVOIR
LOW FLOW AUGMENTATION STUDY

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WATER QUALITY CONTROL

HODGES VILLAGE DAM AND RESERVOIR

LOW FLOW AUGMENTATION STUDY

1. FRENCH RIVER

a. Existing Water Quality Conditions. The French River in the vicinity of Hodges Village Dam is presently degraded below its approved state classification of "B" and does not meet all of the criteria associated with that standard. Data collected by the Corps of Engineers from 1975 through September 1981 and by the Massachusetts Division of Water Pollution Control (MDWPC) in June and August 1976 disclose that the standards for dissolved oxygen(DO), coliform bacteria and pH are violated periodically. In addition, concentrations of primary nutrients, nitrogen and phosphorus, are above levels considered necessary for the initiation of algae blooms. The sources of the majority of the nutrient load in the river are effluents from two upstream wastewater treatment plants, the Leicester and Oxford-Rochdale facilities. These discharges are also the cause of the general degradation of the river's quality.

b. Future Water Quality Conditions. It is expected that water quality conditions in the French River above Hodges Village Dam will be significantly improved by 1983 with the implementation of new management plans for the upstream watershed. Current plans call for the upgrading of the Leicester wastewater treatment plant to advanced secondary treatment by adding spray application of the effluent to land upstream from Sargent Pond, which is in the headwaters of the French River. The Oxford-Rochdale plant treatment processes will not be changed. Some unsewered areas that were to be tied into the Oxford-Rochdale plant will be tied into the Leicester plant instead. The MDWPC expects these actions will remove the major nutrient sources to the proposed augmentation pool, and that nitrogen and phosphorus loads will then decline to near background levels that are below threshold levels needed for algae bloom propagation.

c. Water Quality Requirements for Low Flow Augmentation. Due to the fact that the U.S. Environmental Protection Agency and the MDWPC expect water quality conditions in the reach of the French River below Webster and Dudley, Massachusetts to remain below adopted state standards even after treatment plant upgradings, a scheme for streamflow quality enhancement has been determined by the MDWPC. This plan requires that a flow rate of 22 cfs be maintained at the USGS gaging station on the French River at Webster and that the DO and biochemical oxygen demand (BOD) of the discharge from Hodges Village Dam be at least 6.0 mg/1 and not more than 3.0 mg/1, respectively.

A high quality water has to be provided from the augmentation impoundment. This requirement dictates that an evaluation of reservoir management alternatives be performed in order to define actions needed to meet this goal.

2. HODGES VILLAGE RESERVOIR

a. Site Preparation.

(1) General. The creation of an impoundment behind Hodges Village Dam would inundate 200 acres of land and transform the free-flowing stream environment into a quiescent lake environment. This action would provide ample opportunity for biologically and chemically mediated transformations of water quality to take place. The prime concern about this impoundment is the possible development of nuisance algae blooms and the associated problems of diurnal variations in dissolved oxygen in the pool and consequential detrimental effects downstream. With the removal of the major point sources of the nutrient load in the French River, the critical factor to be addressed regarding potential algae production and overall lake water quality is the effect of the vegetation and soils within the reservoir area that would be inundated.

There are three options commonly used to prepare a reservoir site for inundation: clearing, clearing and grubbing, and clearing, grubbing and stripping. Clearing involves the removal of all woody growth and brush down to some predetermined size, while grubbing involves the removal of stumps. Stripping is the most severe option, requiring, in addition to clearing and grubbing, the removal of loam and forest floor debris down to mineral soil.

(2) Column Studies

(a) General. As an aid in determining the sort of site preparation required in the areas to be inundated by the low flow augmentation pool, 9 soil-water contact columns were set up in the NED soils laboratory. These consisted of plexiglass cylinders each containing a soil sample from a different area of the dam site (see plate 1). Tapwater was added to these columns to a depth of about 4 feet and then the columns were allowed to stand in a dark room at 20°C. On the day after filling and at the end of every 2-week interval after that for 3 months, a water sample was withdrawn from each column through a port 4 inches above the top of the sediment. The samples were analyzed for pH, NH_3-N, NO_3-N, DO and total PO_4-P. Tables 1 through 5 contain the results of these analyses.

A careful analysis of the results of these soil-water contact studies showed that certain areas of the proposed impoundment site will require clearing, grubbing and stripping in order to maintain suitable water quality in the augmentation pool. If the vegetation and

and organic soils in these areas were not removed, the effect on the overlying water would be a slight lowering of the pH, a minor change in the inorganic nitrogen content, a serious depletion of dissolved oxygen, and an increase in the level of phosphate.

(b) pH. The effect of the water contact with the soil samples in the columns was to lower the pH about one-half a unit. The initial pH of the water added to the columns was 6.6. After the first day, the pH dropped and varied between 5.5 and 6.5 with a mean pH of about 6.0 (table 1). This drop was due to an increase in dissolved CO_2 released by decomposing organics and a lack of mixing which would have released this CO_2 to the atmosphere.

Massachusetts Class B water quality standards apply to the French River at Hodges Village Dam and call for a pH not less than 6.5[1]. The water in these columns violates this limit; however, natural mixing and reaeration in the lake would probably raise the pH to acceptable levels.

TABLE 1

RESULTS OF SOIL/WATER COLUMN TESTS
pH

Test Column	Sampling Day 1	14	28	42	56	70	90
PE-1	6.6	5.8	6.2	6.3	5.5	6.2	6.0
PE-2	6.9	6.2	6.1	6.2	5.5	6.2	6.1
PE-3	6.7	6.5	6.1	6.1	5.7	6.0	6.0
PE-4	7.1	6.0	6.1	6.0	5.9	6.1	6.1
PE-5	6.6	5.5	5.8	5.9	5.9	6.0	6.2
PE-6	6.5	5.6	5.8	5.9	5.9	6.0	6.3
PE-7	6.3	5.5	5.8	6.0	5.8	5.8	6.0
PE-8	6.8	6.0	5.8	5.7	5.8	5.8	6.0
3	6.6	5.8	5.9	5.7	5.7	5.8	5.9
Tapwater	6.6						

(c) Nitrogen. The effect of the soil samples on the nitrogen levels of the water columns was small and, possibly, beneficial. Ammonia-nitrogen levels were low. The large majority of samples tested had less than 0.1 mg/l NH_3-N (table 2). Nitrate-nitrogen levels, while showing some fluctuations, generally decreased during the study. The NO_3-N level in the water added to the columns was 0.37 mg/l. After two weeks, most of the samples showed 0.10 mg/l or less NO_3-N and none showed more than 0.25 mg/l. After 90 days, none of the samples tested had more than 0.14 mg/l NO_3-N (table 3). The reasons for this decrease are denitrification and adsorption.

(d) Dissolved Oxygen. The effects of the soil samples on the rates of dissolved oxygen depletion in the columns were difficult to analyze. The initial DO concentration in the tapwater used to fill the columns was 9.2 mg/l. The DO in the water withdrawn for analyses showed a general downward trend overtime but with erratic swings. For example: the samples withdrawn from column PE-1 had DO concentrations of 6.5 mg/l on the second week, 7.2 mg/l on the fourth week, 3.2 mg/l on the sixth week, 2.9 mg/l on the eighth week, 3.8 mg/l on the tenth week, and 3.0 mg/l at the end of three months. These swings in the DO levels indicate that a DO concentration gradient existed above the soil water interface and that the sampling process withdrew both low DO water from below the sampling port and water higher in DO from above the port. However, the slope of this gradient and the relative volumes withdrawn from above and below the port are not known. It is suspected that at least some of the columns had an anaerobic layer existing just above the soil water interface.

Except for PE-2 and 3, all columns had at least one sample which tested at below 5.0 mg/l which is the minimum DO concentration allowed for Massachusetts Class B waters. None of the samples tested were anaerobic; the lowest DO level measured was 1.3 mg/l. However, because samples were withdrawn from water with a DO concentration gradient, a DO value in the sample of less than 2.0 mg/l most likely indicates anaerobic conditions existed at the bottom of the water column. This would mean that columns PE-3 and PE-8 had anaerobic layers by the eighth week. However, depending on the slope of the DO concentration gradient, a DO level higher than 2.0 mg/l might still indicate an anaerobic bottom layer.

TABLE 2

RESULTS OF SOIL/WATER COLUMN TESTS
AMMONIA - NITROGEN
(mg/l)

Test Column	Sampling Day 1	14	28	42	56	70	90
PE-1	K0.1	K0.1	0.12	0.12	K0.1	K0.1	K0.1
PE-2	0.20	0.30	K0.1	0.12			
PE-3	K0.1	K0.1		K0.1			
PE-4							
PE-5							
PE-6							
PE-7							
PE-8							
3		K0.1	K0.1	K0.1	K0.1	K0.1	K0.1
Tapwater	K0.1						

Note: K denotes less than value indicated

TABLE 3

RESULTS OF SOIL/WATER COLUMN TESTS
NITRATE - NITROGEN
(mg/l)

Test Column	Sampling Day 1	14	28	42	56	70	90
PE-1	0.24	K0.1	0.10	K0.1	K0.1	K0.1	K0.1
PE-2	0.34	0.21	0.28	0.14	0.25	0.12	0.14
PE-3	0.12	0.10	0.18	K0.1	0.15	0.10	K0.1
PE-4	0.23	K0.1	0.11		K0.1	0.20	
PE-5	0.15		K0.1			K0.1	
PE-6	0.20		0.30			K0.1	
PE-7	0.18	K0.1	K0.1	K0.1	K0.1	K0.1	K0.1
PE-8	0.27	0.15	0.16	0.11	0.20	0.11	0.11
3	0.31	0.11	0.10	0.10	0.22	0.12	0.12
Tapwater	0.37						

Note: K denotes less than value indicated

The occurrence of anaerobic conditions in the bottom of these columns, which experienced essentially no mixing, does not prove anaerobic conditions will exist at the bottom of an impoundment in which both mixing and reaeration are taking place. However, the column studies do show that the soils in the impoundment area, except for those represented by columns PE-2 and 3, have the ability to exert a significant demand on the oxygen resources of the augmentation pool and may cause anaerobic conditions to exist at the bottom. The results of the dissolved oxygen analyses are presented on table 4.

(e) Phosphate. The effect of the soil samples on the phosphate levels of the water columns was to increase it by at least two and one-half times. The total PO_4-P in the tapwater added to the columns was 0.02 mg/l. After two weeks, the total PO_4-P level in all samples tested was between 0.05 and 0.20 mg/l (table 5). Phosphate levels increased or decreased each time they were measured, thus making it unclear as to whether there was any overall rising or falling trend.

Because of the lack of mixing in the columns and the vagaries inherent in the method of sampling, the exact rate of phosphate release is unknown. However, a minimum phosphate release rate can be calculated. For example: from column PE-1, 7 samples of 350 ml each were withdrawn, and the average total PO_4-P concentration in these was 0.067 mg/l. Subtracting out the 0.02 mg/l initial concentration gives an average increase due to contact with the soil of 0.047 mg/l. Multiplying this by the 2.45 liters of water withdrawn from the column, and dividing by the 0.047 square foot of soil in contact with the water and again by the 90-day duration of the sampling period gives a minimum total PO_4-P release rate of 0.028 mg/day/ft^2. Phosphate release rates were calculated in this manner for all 9 columns and the results are presented in table 6.

The phosphate release rates vary from 0.025 to 0.060 with a mean of 0.037 mg total PO_4-P/day/ft^2. These are minimum rates because it is assumed that, due to the lack of mixing, a concentration gradient existed above the sediment-water interface and the sampling process withdrew water with less than the maximum phosphate concentration.

The release rates in table 6 can be compared with the

TABLE 4

RESULTS OF SOIL/WATER COLUMN TESTS
DISSOLVED OXYGEN
(mg/l)

Test Column	Sampling Day 1	14	28	42	56	70	90
PE-1	9.2	6.5	7.2	3.2	2.9	3.8	3.0
PE-2	9.0	8.0	9.3	8.2	7.2	8.3	9.6
PE-3	9.0	7.2	9.0	6.6	1.6	1.6	8.4
PE-4	9.0	6.2	4.7	2.6	3.3	2.8	4.7
PE-5	9.1	5.8	7.4	7.4	5.0	4.2	5.2
PE-6	9.0	4.0	4.0	3.4	2.2	2.4	3.4
PE-7	9.1	5.2	4.0	5.0	4.0	3.9	4.0
PE-8	9.2	6.9	7.3	5.2	1.4	1.3	1.6
3	9.2	7.8	9.2	8.2	6.3	5.2	6.2
Tapwater	9.2						

TABLE 5

RESULTS OF SOIL/WATER COLUMN TESTS
TOTAL PHOSPHATE - PHOSPHORUS
(mg/l)

Test Column	Sampling Day 1	14	28	42	56	70	90
PE-1	0.03	0.05	0.07	0.07	0.09	0.08	0.08
PE-2	0.12	0.08	0.09	0.07	0.09	0.10	0.09
PE-3	0.04	0.07	0.08	0.09	0.14	0.10	0.09
PE-4	0.06	0.09	0.09	0.07	0.07	0.08	0.06
PE-5	0.05	0.06	0.07	0.04	0.05	0.05	0.11
PE-6	0.05	0.08	0.07	0.10	0.07	0.08	0.06
PE-7	0.12	0.09	0.07	0.05	0.05	0.05	0.07
PE-8	0.17	0.07	0.08	0.07	0.14	0.10	0.20
3	0.07	0.07	0.07	0.07	0.10	0.13	0.07
Tapwater	0.02						

TABLE 6

MINIMUM RATES OF PHOSPHATE RELEASE BY SEDIMENTS

Test Column	Total PO_4-P Release Rates ($mg/day/ft^2$)
PE-1	0.028
PE-2	0.043
PE-3	0.0405
PE-4	0.033
PE-5	0.025
PE-6	0.032
PE-7	0.031
PE-8	0.060
3	0.038

reports in the literature of studies involving sediment-water exchange of phosphate. Anderson[2] reported that the sediment in six small, shallow, nonstratified Danish lakes released phosphate at a rate of 1.4 mg/day/ft^2. His laboratory experiments found lower rates. Fillos and Biswas[3] found that under aerobic conditions Lake Mohegan sediments were a sink for phosphate but that under anaerobic conditions the sediments released phosphate at the rate of 0.28 mg/ft^2/day. Burdick and Parker[4] in their study of soils to be inundated by a proposed Tennessee reservoir found that low lying soils released phosphate under both aerobic and anaerobic conditions but at higher rates under anaerobic conditions. Upland soils did not exchange phosphate with overlying waters. DiGiano[5] found no release of phosphate from soils taken from the proposed Beaver Brook Lake site when covered with aerobic water.

In order to calculate the effect of the rates of phosphate release in table 6 on the phosphate concentration in the proposed pool, the following assumptions were made: (1) that the inundated sediments were the only sources of phosphate to the pool, (2) that the impoundment was completely mixed at all times, (3) that the inundated soil released phosphate at a constant rate, and (4) that phosphate behaved as a conservative substance. Using these assumptions, the phosphate concentrations that would have existed in the 22 cfs augmentation pool had it been operated under 1975 hydrologic conditions were calculated for the months of June, July, August and September. The results are given in table 7.

Evaluation of the results indicates that by the end of June, phosphate levels in the pool, due to sediment exchange alone, would still be less than the level that is generally considered to be the threshold limit for algae blooms to occur. By the end of July, the threshold limit would have been achieved or exceeded had the sediments been releasing phosphate at the rates measured in 4 of the 9 columns. All but 1 of the 9 columns was releasing total PO_4-P at a rate that would bring the pool concentration close to the threshold concentration by the end of August, and one of the columns was releasing phosphate at more than twice that rate. In September, the pool volume would have dropped enough and the flow increased enough for the phosphate to be reduced to or below 0.003 mg/l total PO_4-P.

Although the levels of phosphate in table 5 represent minimum concentrations, being based on minimum release rates, it is possible that the actual release rates in the augmentation

TABLE 7

MINIMUM TOTAL PO_4-P CONCENTRATIONS DUE TO SEDIMENT RELEASE IN THE 22 CFS LOW FLOW AUGMENTATION POOL (mg/l)

Site	30 June	31 July	31 Aug.	30 Sept.
PE-1	0.003	0.007	0.010	0.001
PE-2	0.005	0.011	0.016	0.002
PE-3	0.004	0.011	0.015	0.002
PE-4	0.004	0.009	0.012	0.002
PE-5	0.003	0.007	0.009	0.001
PE-6	0.003	0.008	0.012	0.002
PE-7	0.003	0.008	0.012	0.001
PE-8	0.006	0.016	0.022	0.003
3	0.004	0.010	0.014	0.002

pool would be lower. It is generally accepted that sediments release phosphate at higher rates under anaerobic than under aerobic conditions. If the phosphate release in the columns was affected by an anaerobic layer of water above the soil and mixing and reaeration in the pool would prevent the formation of this anaerobic layer, then phosphate release rates in the pool might be lower than in the columns. This is unlikely, however, for although the highest levels of phosphate were associated with very low DO concentrations in the samples from the columns; PE-2, which never had a measured DO level less than 7.2 mg/1, showed PO_4-P levels not significantly different from that in other columns.

(3) Conclusions. A summary of the results of the column studies is given in table 8, which ranks the soils in each column according to the water quality to be expected if these soils were inundated. This ranking is based on DO, PO_4-P, and color results from the column studies, organic content as determined by the soils testing laboratory and odor as determined in the field. According to this ranking, the soil in column PE-5 was the best and in column PE-8 was the worst. Sample 3 is a woodland soil and a special case. It was the only soil sample to impart a high degree of color to the water.

After evaluating the effects of the soils on the inundating water, the final factor in deciding whether or not to strip the organic soils is the length of time the soil will be inundated under the planned modes of pool operation for low flow augmentation. Table 9 gives the elevations of the areas within the dam site represented by each column, the monthly elevations of the augmentation pool during the summer, and the date when each area will be no longer inundated.

TABLE 8

RANKING OF SOIL SAMPLES IN TERMS OF DEGREE OF NEGATIVE IMPACT ON WATER QUALITY

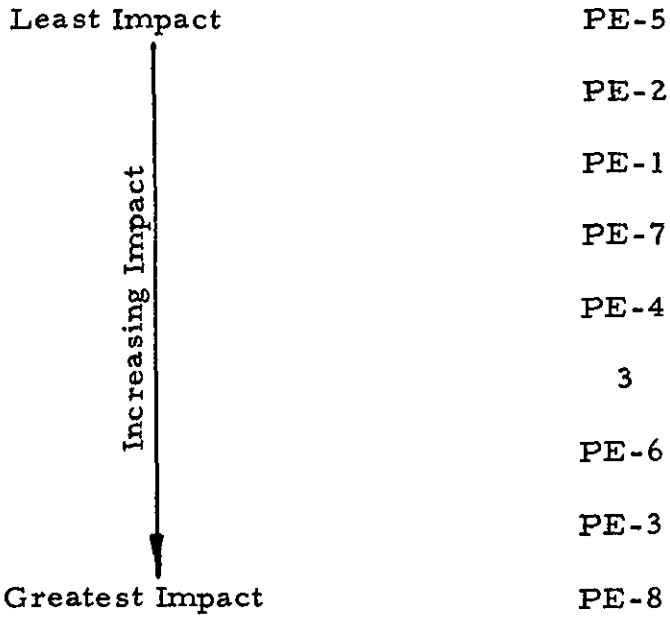

TABLE 9

COMPARATIVE LEVELS OF THE AUGMENTATION POOL DURING SUMMER

Date	22 cfs LFA Pool Elevation	
	Maximum (ft, msl)	Minimum (ft, msl)
31 May	475.6	475.6
30 June	475.5	475.5
31 July	474.8	474.6
31 Aug	474.2	473.7
30 Sept	472.3	472.1
31 Oct	472.0	472.0

Site	Elevation	22 cfs LFA Pool Date of Exposure
PE-1	469	*
PE-2	475	15 July
PE-3	471	*
PE-4	476	1 May
PE-5	479	1 May
PE-6	470	*
PE-7	474	15 Aug
PE-8	469	*
3	475	15 July

* Site always remains inundated

For the 22 cfs low flow augmentation pool, areas PE-1, PE-3, PE-6, PE-8, and 3 would require clearing and stripping and area PE-7 would require clearing. An examination of table 9 shows that areas represented by columns PE-4 and PE-5 will not require stripping or even clearing because they will not be affected by the 22 cfs augmentation pool. Areas represented by PE-2 would be under water until mid-July according to this table. However, a visit to the site by a member of the Water Control Branch during spring when the pool elevation was up to 475.5 feet msl did not disclose any water in this area. Furthermore, the soil sample from this area when inundated in the column gave one of the best quality waters. Therefore, this area would not require stripping or clearing.

The site represented by column PE-7 would not require stripping for the 22 cfs augmentation pool. This site would be inundated until mid-August and the soil is ranked at only moderate quality in table 8. However, this site will be covered by a maximum of about 1.5 feet of water, which will account for only a small portion of total pool volume, and, furthermore, is separated from the rest of the impoundment by a dike formed by an old railroad bed. Therefore, the effects of this area on the main pool would be minor.

The area that must be stripped to achieve high water quality in the 22 cfs impoundment (that which includes the worst soils as given in table 8 and which would be inundated the longest) can be roughly delineated as follows: on the south this area is bounded by the dam, on the east by the dirt road, on the west by the old railroad bed, and on the north by Old Charlton Road (see plate 2).

b. Future Lake Water Quality. If the Hodges Village Dam is used for low flow augmentation storage with the site preparation outlined above and the proposed upstream improvements in the form of wastewater treatment plant upgrading or diversion of effluents carried out, the water quality in the pool behind the dam should be high. However, even if the upstream improvements are made, if the prescribed site preparation is not performed, the pool will have low DO concentrations and possibly be anaerobic near its bottom with increasing nutrient concentrations during summer. This could lead to massive algae blooms and consequently very low levels of DO in the discharge from the dam during nighttime and early morning hours. The poor quality of release water would negate much of the purpose of this low flow augmentation project.

Strong thermal stratification is not expected to develop in the pool. Slight temperature gradients of several degrees Fahrenheit may develop; however, it is felt that wind-induced currents would tend to destroy any weak stratification and keep the pool fairly well mixed. Summertime lake water temperatures will be very responsive to climatic and inflow conditions with surface temperatures ranging as high as the low eighties (degrees Fahrenheit). The absence of strong stratification in the pool negates the need to provide selective withdrawal capability at the outlet works in order to control discharge quality.

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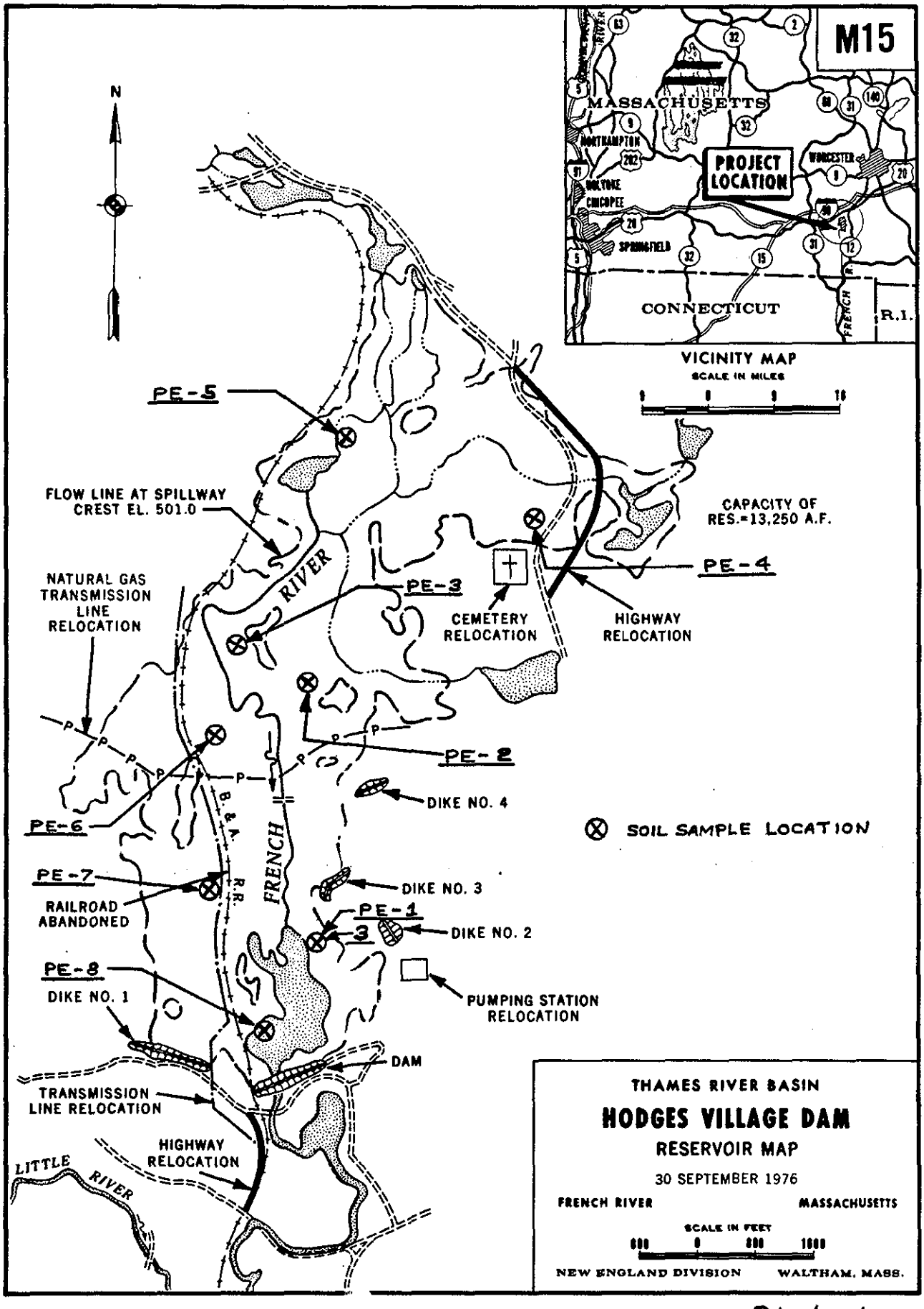

THAMES RIVER BASIN

HODGES VILLAGE DAM

RESERVOIR MAP

30 SEPTEMBER 1976

FRENCH RIVER MASSACHUSETTS

SCALE IN FEET

NEW ENGLAND DIVISION WALTHAM, MASS.

Plate 1

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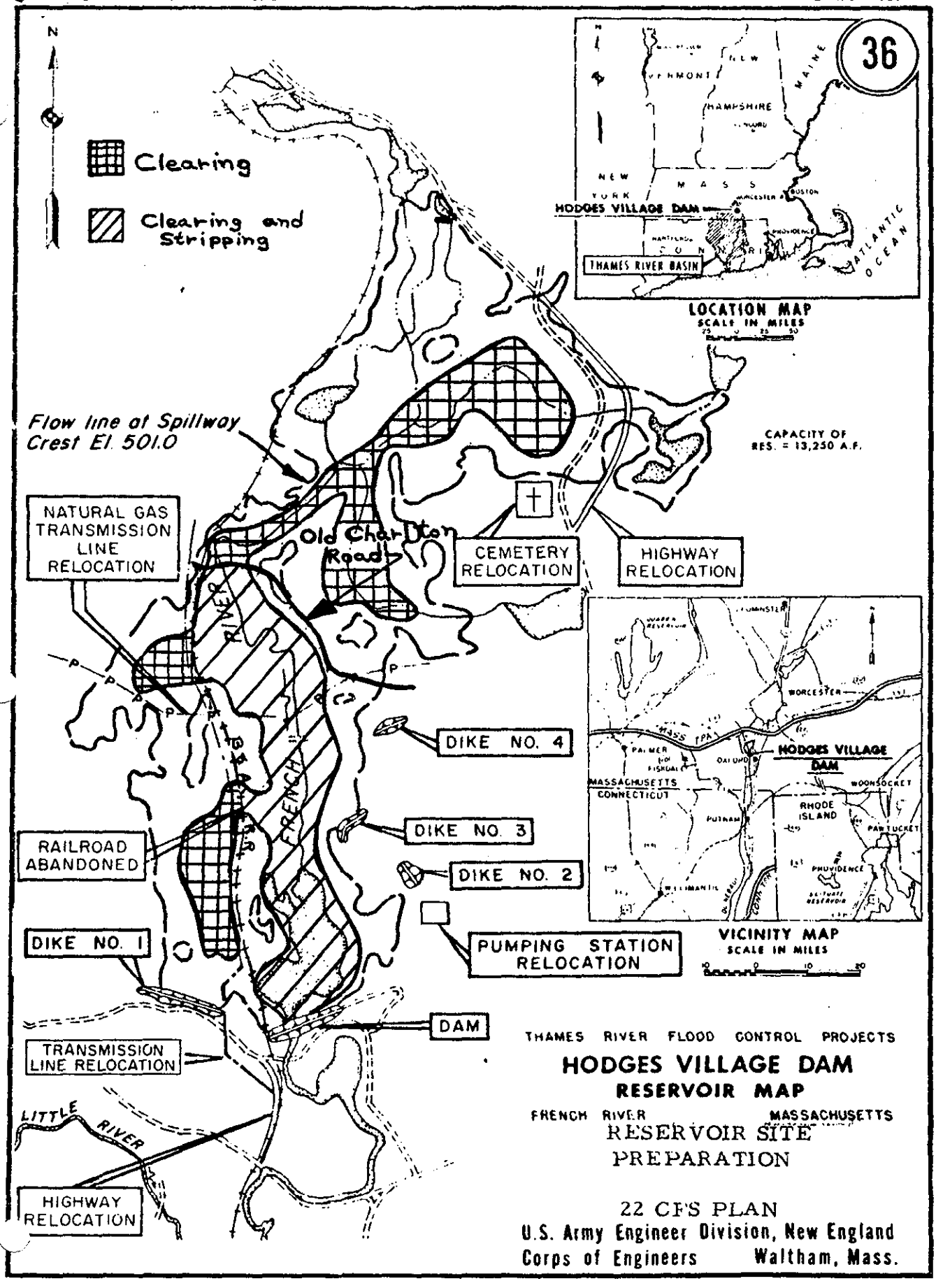

THAMES RIVER FLOOD CONTROL PROJECTS

HODGES VILLAGE DAM

RESERVOIR MAP

FRENCH RIVER MASSACHUSETTS

RESERVOIR SITE PREPARATION

22 CFS PLAN

U.S. Army Engineer Division, New England
Corps of Engineers Waltham, Mass.

Plate 2

B. HYDROLOGY

HYDROLOGY
HODGES VILLAGE DAM AND RESERVOIR
LOW FLOW AUGMENTATION STUDY

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HYDROLOGY
HODGES VILLAGE DAM AND RESERVOIR
LOW FLOW AUGMENTATION STUDY

1. HYDROLOGIC SETTING

The French River, with a drainage area of 112 square miles, is formed at the confluence of Grindstone and Town Meadow Brooks, in Leicester, Massachusetts and flows southerly for a total distance of 28 miles to its confluence with the Quinebaug River at Mechanicsville, Connecticut. It has a total fall of 618 feet. Within its watershed are numerous natural and artificial reservoirs, the largest being Lake Webster, with a drainage area of 11 square miles and a surface area of 2 square miles.

Hodges Village Dam, completed in 1959, is located in Oxford, Massachusetts on the French River about 16 miles above the confluence with the Quinebaug River. The reservoir has a total storage capacity of 13,250 acre feet, equivalent to 8.0 inches of runoff from its contributing drainage area of 31.1 square miles.

The watershed above the dam shown on Plate 1, is elongated with a maximum length of about 11 miles and maximum width of about 4.5 miles. The divide varies from 470 feet msl at the dam to 1,185 feet msl at Elliot Hill in Leicester, Massachusetts. While portions of the watershed are fairly steep and conducive to rapid runoff, there is considerable storage, both natural and manmade. The two principal tributaries of the French River above Hodges Village Dam are Grindstone Brook and Town Meadow Brook. Several large lakes, which significantly reduce flood flows, discharge into Town Meadow Brook. The most effective of these lakes, in terms of flood peak attenuation, are normally kept full for recreational purposes and therefore only surcharge storage is available. Following is a tabulation of available surcharge storage and drainage areas of these lakes:

Lakes	Drainage Area (sq. mi.)	Surcharge Storage	
		Acre-Feet	Inches
Stiles Reservoir	4.6	1575	6.6
Burncoat Pond	2.4	405	3.2
Cedar Meadow Pond	3.4	335	1.8 gross
	1.0 (net)		6.2 net
Sargent Pond	2.8	280	1.9

The U.S. Geological Survey maintains three streamflow gaging stations within the watershed and pertinent data is listed below:

Gaging Station	Period of Record	DA (sq mi)	Mean Annual Runoff (inches)	Discharge		
				Mean Annual (cfs)	Maximum Instantaneous (cfs)	Minimum Daily (cfs)
French River at Webster	1948-1980	85.3	25.5	159	14,400	2.2
French River below Hodges Village Dam	1962-1980	31.0	23.83	54.4	628	2.0
Little River near Oxford, Mass.	1939-1980	27.7	23.53	48.0	8,340	0.1

The Webster gage will be utilized to determine the quantity of augmentation releases from Hodges Village Dam; monthly and annual discharge records are shown below:

FRENCH RIVER AT WEBSTER

MONTHLY RUNOFF
(1948-1976)

Month	Mean (cfs - inches)	Maximum (cfs - inches)	Minimum (cfs - inches)
January	188 - 2.42	323 - 4.36	40 - 0.54
February	207 - 2.55	474 - 5.78	92 - 1.13
March	303 - 4.11	669 - 9.05	163 - 2.20
April	320 - 4.18	608 - 7.95	97 - 1.27
May	177 - 2.39	379 - 5.13	70 - 0.96
June	110 - 1.45	373 - 4.88	46 - 0.61
July	62 - 0.83	229 - 3.09	23 - 0.31
August	70 - 0.95	712 - 9.60	18 - 0.25
September	72 - 0.96	455 - 5.96	21 - 0.28
October	84 - 1.13	365 - 4.94	24 - 0.32
November	135 - 1.77	442 - 5.78	25 - 0.33
December	182 - 2.47	348 - 4.71	34 - 0.46
ANNUAL	158 - 25.13	231 - 36.85	65 - 10.42

WATER YEAR RUNOFF

Year	CFS - Inches	Year	CFS - Inches	Year	CFS - Inches
1950	90 - 14.86	1961	150 - 23.80	1971	123 - 19.58
1951	149 - 23.72	1962	134 - 21.30	1972	230 - 36.74
1952	194 - 30.93	1963	134 - 21.39	1973	225 - 35.84
1953	175 - 27.78	1964	108 - 17.17	1974	174 - 27.73
1054	229 - 36.43	1965	65 - 10.42	1975	160 - 25.29
1955	231 - 36.85	1966	69 - 10.95	1976	181 - 28.88
1956	96 - 15.23	1967	149 - 23.74	1977	123 - 19.75
1957	176 - 27.96	1968	159 - 25.41	1978	209 - 33.56
1958	170 - 27.09	1969	117 - 18.58	1979	197 - 31.63
1959	196 - 31.26	1970	175 - 27.92	1980	139 - 22.32
1960	201 - 32.14				

The French River watershed has a variable climate characterized by frequent but short periods of heavy precipitation. The watershed lies in the path of the "prevailing westerlies" and of cyclonic disturbances that cross the country from the west or southwest towards the east or northeast. It is also exposed to occasional coastal storms that travel up the Atlantic Seaboard. Some storms are of tropical origin and occasionally are of hurricane intensity, and heavily laden with moisture from the ocean. The southern watershed escapes the severity of cold and depth of snowfall experienced at the higher elevations in the north.

The average annual temperature in the area is about 48° Fahrenheit, while the average annual precipitation is about 44 inches uniformally distributed throughout the year. Following is a tabulation of monthly climatologic conditions at Putnam, Connecticut through 1965 when the station was discontinued.

PUTNAM, CONNECTICUT

ELEVATION, 240 FEET, MSL

Month	Monthly Precipitation (inches)			Monthly Temperature (°F)		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
Jan	3.56	6.93	0.80	25.2	68	-29
Feb	2.91	5.02	1.09	27.3	69	-23
Mar	3.63	9.43	1.12	35.0	84	-16
Apr	3.87	7.15	0.99	45.8	88	7
May	3.39	5.96	0.94	56.4	98	24
June	3.44	7.71	0.23	65.0	100	31
July	3.98	11.32	0.61	70.3	102	37
Aug	4.14	14.74	0.83	68.1	100	30
Sep	3.64	9.06	0.47	61.1	100	20
Oct	3.24	8.36	0.27	51.1	89	15
Nov	4.54	9.50	0.80	40.6	81	-1
Dec	3.85	8.28	1.02	28.5	66	-16
ANNUAL	44.44	62.07	30.71	47.8	102	-29

2. SPILLWAY DESIGN FLOOD

In the "Spillway Design Flood and General Hydrology" Design Memorandum, dated 12 June 1956, a SDF was developed by applying rainfall from Hydrometeorological Report #28 to the adopted unit hydrograph. This rainfall of 26.2 inches in 24 hours produced a peak inflow of 26,700 cfs. Adjustment was made to allow for the possibility of upstream dam failure, as was experienced in the August 1955 flood. The adopted SDF had a peak inflow in 35,600 cfs and when routed through reservoir storage, produced a peak outflow of 25,800 cfs.

The current "Probable Maximum Precipitation" was determined based on criteria described in the draft Hydrometeorological Report #51, dated September 1976. The maximum 24-hour rainfall was 25.7 inches after being reduced for configuration losses as described in EC 1110-2-27. This compares favorably to the original design rainfall and due to the lack of significant changes in the upstream watershed., it is considered that the original spillway design flood is adequate under current design criteria.

Following is a tabulation of pertinent data for the 1956 adopted Spillway Design Flood.

SPILLWAY DESIGN STORM

Bases of Design	HR #28
24-Hour Rainfall (inches)	26.2

SPILLWAY DESIGN FLOOD

Peak Inflow (cfs)	35,600
Peak Outlfow (cfs)	25,800
Volume of Runoff (acre-feet)	37,000
Volume of Runoff (inches)	22.3

RESERVOIR REGULATION PLAN

Initial Pool Elevation (ft., msl)	501.0 (spillway crest)
Outlet Facilities	Closed
Maximum Surcharge Elevation (ft., msl)	515.0
Top of Dam Elevation (ft., msl)	520.0

3. LOW FLOW AUGMENTATION RELIABILITY

In letter dated 9 November 1977, the Massachusetts Water Resources Commission stated that a minimum flow of 22 cfs at the USGS gage at Webster, Massachusetts was required to reach assigned water quality standards in the lower portion of the French River. An analysis of the discharge records at Webster and Hodges Village Dam, in conjunction with the NED "Monthly Storage Analysis" (MSA) computer program indicates that with 0.3 inch of reservoir storage available for low flow augmentation, this streamflow requirement of 22 cfs would be met with a reliability in excess of 9 out of 10 days

for the period 1 June through 31 October. The period of analysis extended from 1 June through 31 October for the years 1959 through 1975, and included the record drought period of 1961-1966. The MSA program compared the daily flows at Hodges Village and Webster along with the desired flow at Webster to develop the required reservoir storage.

Following is a tabulation of reservoir data associated with required flows at Webster:

Flow at Webster (cfs)	22
Pool stage (feet)	10.1
Pool elevation (feet msl)	475.6
Pool area (acres)	200
Storage (acre-feet)	700
Storage (inches)	0.42
Pool evaporation losses (inches runoff)*	0.10
Begin buildup of Hodges Village pool**	1 May

* Losses determined by using data developed in the 1974 "Merrimack Wastewater Management" Study

** Store all inflows in excess of 10 cfs

The above pool includes a small permanent pool for aesthetic purposes. The permanent pool would be at about elevation 472 (stage of 6.5 feet), have an area of 90 acres and storage of 190 acre-feet, equivalent to about 0.1 inch of runoff.

4. DOWNSTREAM CHANNEL CAPACITY

Hodges Village Dam is primarily operated in conjunction with Buffumville Lake to provide protection for Webster and other communities downstream on the French River, and secondly for downstream communities on the Quinebaug River. The principal index point used in flood regulation is the USGS gage at Webster where the maximum nondamaging channel capacity is 1,000 cfs. Immediately downstream of Hodges Village the maximum channel capacity is 550 cfs during the nongrowing season and about 400 cfs during the growing season.

5. LOW FLOW RULE CURVE

The hurricane season, as defined by the National Weather Service, runs June through October; however, the highest incidences of damaging storms in New England have been experienced in August and September. For this reason a rule curve, shown on Plate 2, has been established for the 22 cfs requirement that regains most of the flood control storage by the first of September.

6. FLOOD CONTROL REGULATION

The flood of record in the French River watershed occurred on 19 August 1955 and has an estimated frequency of about 200 years. The event was produced by intense rainfall associated with hurricane "Diane", which was preceded by substantial rainfall from hurricane "Connie" one week earlier. Hurricane "Connie" deposited from 3 to 6 inches of precipitation in the Thames Basin. Hurricane "Diane" produced rainfall from 10 to 16 inches in the headwaters of the French River watershed.

A hydrologic analysis of a repeat of the August 1955 flood, with an augmentation pool at Hodges Village, was accomplished to determine the effect on our flood control capability at Webster. The assumed pool stage of 8.8 feet corresponds to the rule curve stage for 19 August. Following is a tabulation of drainage areas contributing to the flow at Webster:

Drainage Area	Square Miles
Buffumville Lake	26.5
Hodges Village Dam	31.1
Local at Webster	16.7
Lake Webster	11.0
Total	85.3

The observed peak discharge at Webster occurred on 19 August 1955 with a flow of 14,400 cfs. Lake Webster, with its 2-square mile surface area and restricted outlet capacity naturally desynchronizes peak flows. The flow from the local drainage area was determined to be about 4,000 cfs. With full flood control capacity, 8.0 inches at Buffumville Lake and either 8.0 or 7.7 inches at Hodges Village the resulting peak flow at Webster of 4,500 cfs would be caused by runoff from the uncontrolled drainage area. Spillway discharge from both reservoirs would result in a smaller secondary peak.

Although the peak discharge at Webster in a recurrence of the 1955 event would be created by the uncontrolled runoff, the flow immediately downstream from Hodges Village would be directly related to spillway discharge. A tabulation of spillway discharge for the existing and 22 cfs condition follows:

	August 1955 Flood	
	Initial Pool Stage (ft)	Spillway Discharge (cfs)
No Augmentation Pool	3±	400
22 CFS Requirement	8.8	500

The maximum nondamaging channel capacity downstream of the dam is 575-600 cfs. Consequently, there would be no increase in damages along the French River above the confluence with the Little River. If the project had not been built the flow would be 10,000 cfs.

A standard project flood (SPF) was developed for this study to determine the effectiveness of the Buffumville and Hodges Village reservoirs with a 107-foot augmentation pool at Hodges Village. The synthetic storm was centered in such a manner as to produce highest discharges at Webster. Without Buffumville and Hodges Village, the maximum 24-hour rainfall of 11.24 inches would produce a peak at Webster of 13,900 cfs. The local area (5,000 cfs) produced the major portion of the modified peak discharge (5,200 cfs) with spillway discharge from the upstream projects affecting only the recession side of the hydrograph. Following is a tabulation of spillway discharges at Hodges Village for the existing condition and conditions with the proposed augmentation pool:

	Standard Project Flood	
	Initial Pool Stage (ft)	Spillway Discharge (cfs)
No Augmentation Pool	3±	0
22 CFS Requirement	10.1	200

An analysis of experienced pool stages for the 18 years the facility has been in operation indicates that the proposed augmentation pool would not adversely affect the flood control capability of Hodges Village Dam. For example the observed peak storages for the period 1 April through 31 October were added to the rule curve for the 22 cfs flow and resulted in a maximum pool stage of 14.5 feet (15%), in late May. However, it must be mentioned the project has not experienced a major flood since completion. Proposed seasonal use of storage for flow augmentation purposes will not have a significantly adverse impact on Corps flood control activities within the French River watershed.

7. DROUGHT HISTORY

The drought history in the watershed extends back more than 100 years. Since the establishment of stream gaging stations two rather extensive periods have occurred when amounts of runoff in the watershed were far below normal. The first occurred during water years 1930 through 1932, inclusive and the second, and most severe, began in the latter part of water year 1961 and extended through the middle of water year 1966. During this 5-year period, the cumulative precipitation deficiency in the watershed was about 64 inches which is approximately 145 percent of the average annual precipitation. The cumulative runoff deficiency for water years 1961 through 1966 for the French River at Webster was 45.8 inches

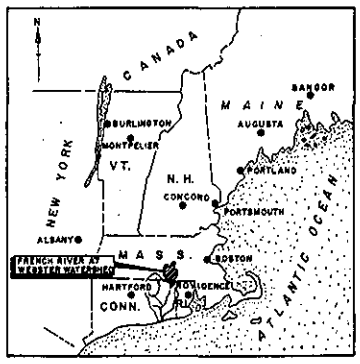
which is 182 percent of the average annual runoff. Rarely is a deficiency of ground water carried over from one growing season to the next in New England, since it is replenished during each spring runoff. However, this condition occurred in the winter of 1964-1965 and resulted in a record low runoff in water year 1965 at Webster of 10.4 inches which is 41 percent of the average annual runoff. The daily discharge record for the French River at Webster for water year 1965 is shown on Plate 3.

8. SAMPLE OPERATION

Water year 1965 was the worst drought year experienced since records have been kept. For this reason is was chosen to show as a sample operation for the 22 cfs requirement. In making releases from Hodges Village to augment flows at Webster a number of parameters must be considered; a) 2 day travel time, b) current Webster discharge, c) weather conditions and d) previous day's release. Plate 4 indicates the required action taken at Hodges Village Dam to meet the target flow of 22 cfs at Webster in a repeat of the 1965 event. It should be noted on Plate 4 it was necessary to reduce the target flow to 20 cfs on 16 August. This reduction was necessary to insure that there would be sufficient water for later in the augmentation season.

9. EMERGENCY EVACUATION

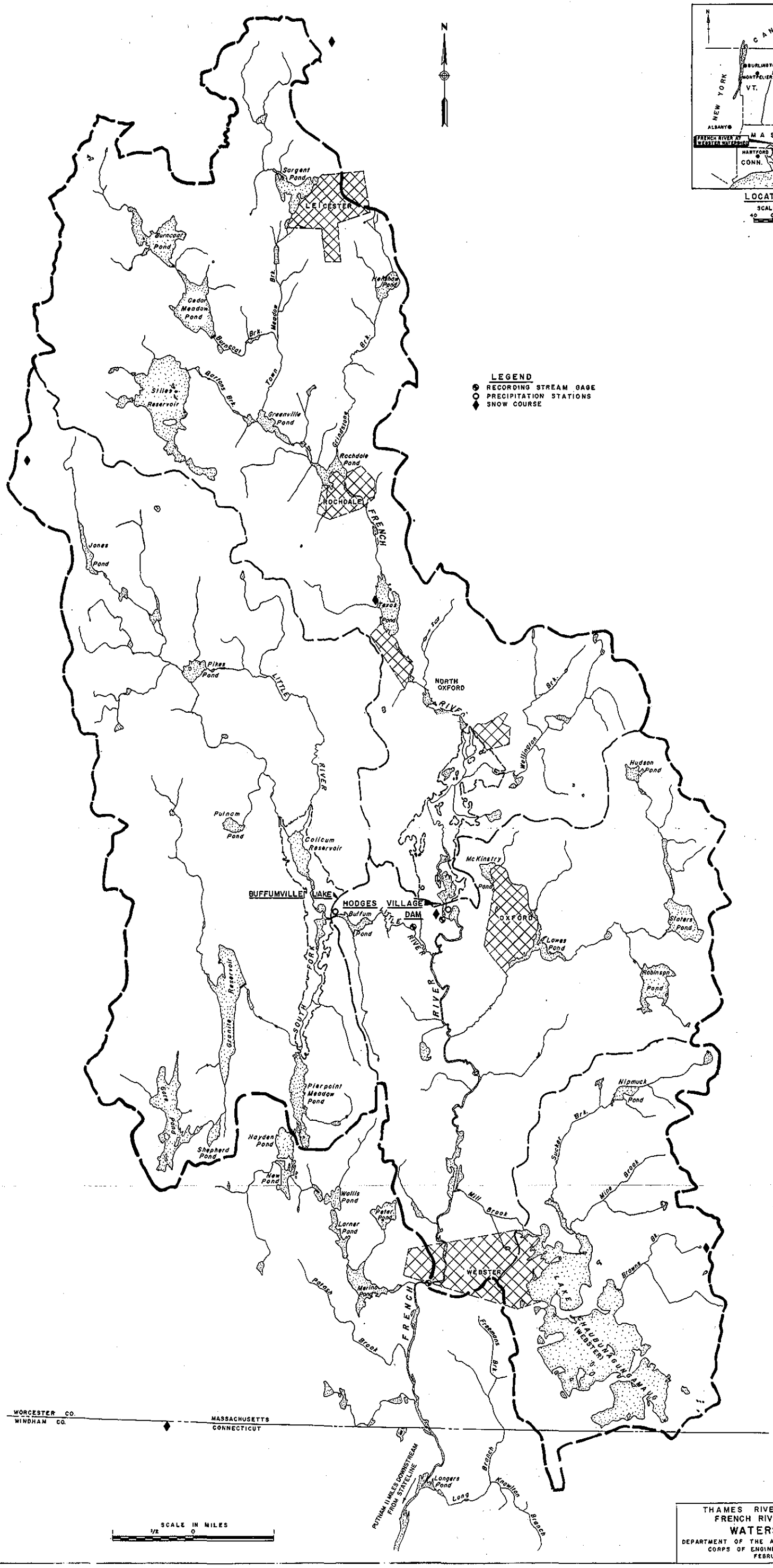
With the reservoir filled to spillway crest, an inflow of 3 csm (95 cfs) and a maximum release rate of 550 cfs, it would require about 14.5 days to empty the flood control pool. Under extreme flood conditions, releases could exceed 550 cfs. This two week period is consistent with other projects in the New England Division.



LOCATION MAP

SCALE IN MILES

40 0 40 80



LEGEND

- RECORDING STREAM GAGE
- PRECIPITATION STATIONS
- SNOW COURSE

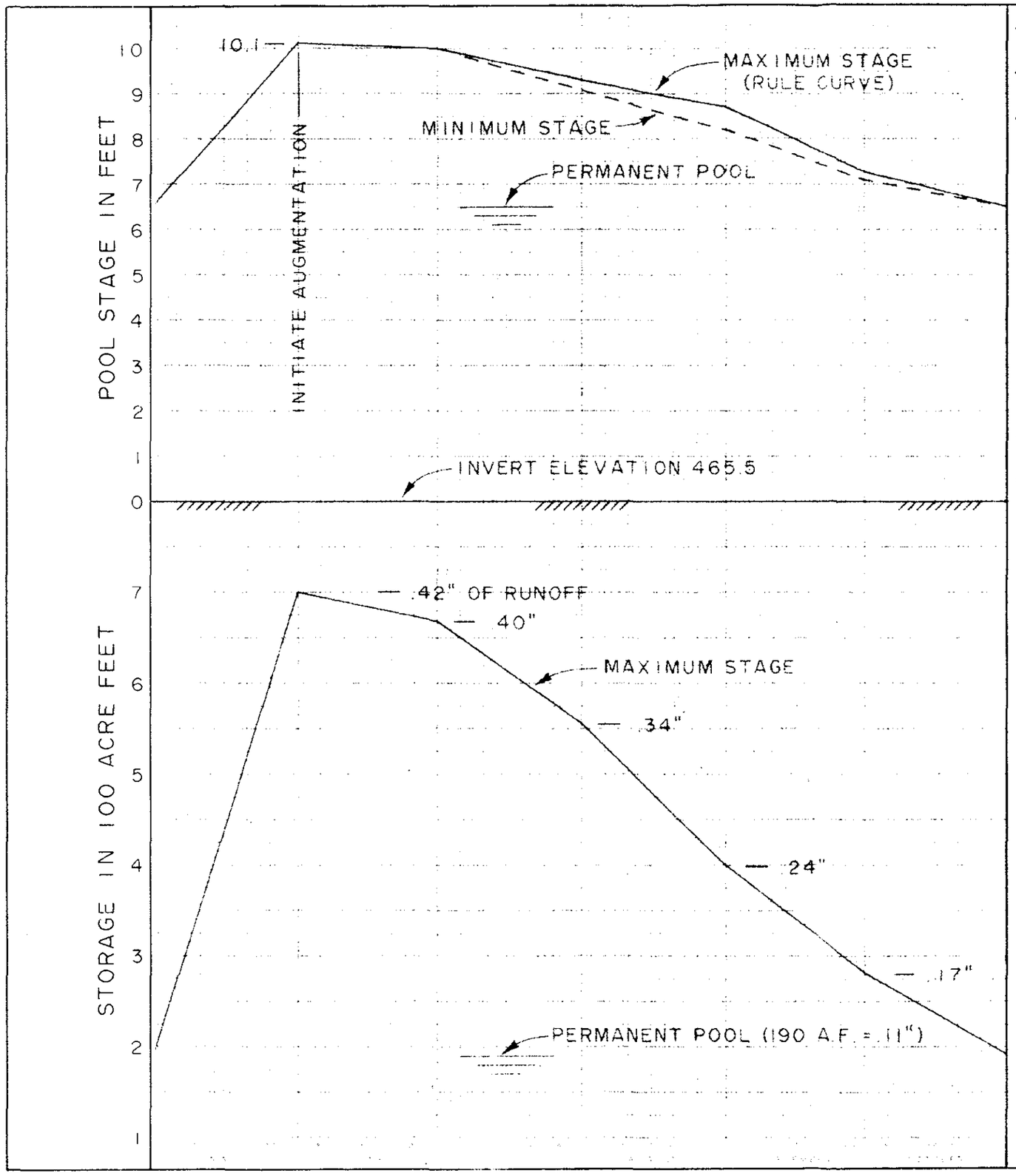
SCALE IN MILES

½ 0

THAMES RIVER FLOOD CONTROL
FRENCH RIVER AT WEBSTER
WATERSHED MAP

DEPARTMENT OF THE ARMY - NEW ENGLAND DIVISION
CORPS OF ENGINEERS - WALTHAM, MASS.
FEBRUARY 1978

PLATE 1



NOTES:

1. BEGIN BUILD-UP OF LOW FLOW AUGMENTATION POOL ON 1 MAY, LIMIT OUTFLOW TO 10 C.F.S.
2. IF POOL STAGE DROPS BELOW MINIMUM STAGE LINE, REDUCE TARGET FLOW AT WEBSTER TO 20 C.F.S.
3. IF FLOWS AT WEBSTER ARE ABOVE 22 C.F.S., MAKE RELEASES TO FOLLOW MAXIMUM STAGE LINE.
4. MINIMUM DISCHARGE SHALL BE 10 C.F.S. OR INFLOW WHICHEVER IS LESS.

WATER RESOURCES DEVELOPMENT PROJECT

THAMES RIVER BASIN
HODGES VILLAGE DAM

RULE CURVE
22 C.F.S. AT WEBSTER

NEW ENGLAND DIVISION, NEEDHAM, MASS.
FEBRUARY 1978

PLATE 2

1-1250. French River at Webster, Mass.

Location.--Lat 42°03'03", long 71°53'08", on right bank 50 ft upstream from Pleasant Street Bridge at Webster, Worcester County, and 1.1 miles upstream from Potash Brook.

Drainage area.--85.3 sq mi.

Records available.--December 1948 to September 1965.

Gage.--Water-stage recorder (digital). Datum of gage is 406.74 ft above mean sea level, datum of 1929.

Average discharge.--16 years (1949-65), 156 cfs (adjusted for storage in flood-control reservoirs).

Extremes.--Maximum discharge during year, 408 cfs Feb. 27 (gage height, 5.91 ft); minimum daily, 2.2 cfs Aug. 15.
1948-65: Maximum discharge, 14,400 cfs Aug. 19, 1955 (gage height, 26.05 ft, from floodmarks), from rating curve extended above 2,400 cfs on basis of computation of peak flow over dam; minimum daily, that of Aug. 15, 1965.
Flood of Mar. 19, 1936, reached a discharge of 4,700 cfs, by computation of flow over dam about half a mile upstream.

Remarks.--Records good except those for day of no gage-height record, which are fair. Flow regulated by mills, by Lake Chaubunagungamaug (estimated usable capacity, 207,000,000 cu ft), and by Buffumville and Hodges Village Reservoirs (see p. 114) and smaller reservoirs above station.

Rating table, water year 1964-65 (gage height, in feet, and discharge, in cubic feet per second)

4.08	2.2	4.6	31
4.1	2.5	4.9	73
4.2	5.0	5.2	140
4.3	8.9	5.5	245
4.4	14	6.0	440

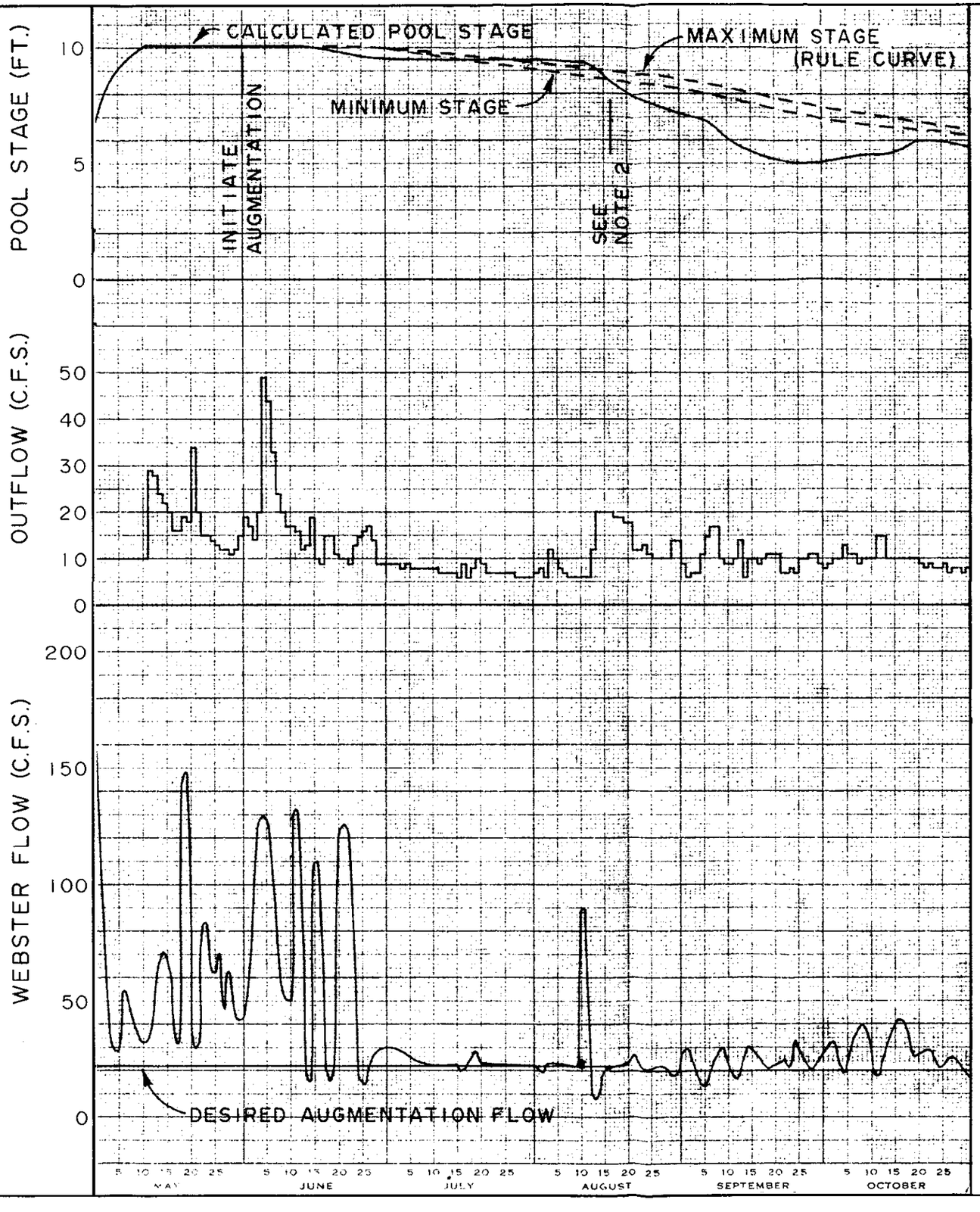
DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1964 TO SEPTEMBER 1965

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	49	5.1	63	50	51	217	130	170	43	29	20	21
2	18	a45	67	86	67	177	122	112	57	27	23	25
3	4.7	*38	41	37	62	170	107	114	66	26	22	22
4	4.4	26	23	124	59	174	96	107	130	24	*23	16
5	59	14	53	94	46	195	92	62	107	24	23	14
6	65	41.	7.6	14	29	221	107	84	84	24	23	13
7	*47	6.8	81	31	5.8	241	94	79	66	23	23	13
8	32	6.5	59	39	70	249	101	62	86	24	22	16
9	32	49	*63	41	149	249	101	53	50	23	22	16
10	2.7	44	32	44	*195	245	71	51	54	23	90	*18
11	2.7	30	53	47	191	233	75	54	132	23	43	16
12	30	29	19	50	177	191	114	53	94	23	16	14
13	36	18	3.4	*50	170	177	164	51	5.4	23	2.9	29
14	35	6.8	68	49	152	152	209	71	15	24	3.9	32
15	37	6.8	67	44	137	146	99	47	107	24	2.4	29
16	41	38	65	41	107	135	132	41	62	23	2.9	28
17	4.4	43	77	36	117	122	233	143	6.8	25	3.4	23
18	4.4	23	75	32	103	107	253	149	16	26	3.6	20
19	46	8.5	3.1	32	101	117	249	63	19	23	5.1	16
20	12	37	4.1	32	53	114	237	11	24	25	5.1	16
21	42	4.1	65	32	57	107	229	49	122	24	16	21
22	38	3.9	60	30	96	103	217	77	70	24	16	21
23	44	42	67	31	79	*110	195	84	16	24	18	21
24	2.9	43	19	32	83	119	181	73	* 7.2	24	18	23
25	2.9	16	2.9	35	122	124	170	62	2.9	23	18	32
26	46	9.8	10	67	277	140	*174	71	3.9	23	18	21
27	7.6	62	73	54	313	152	181	47	8.9	23	18	21
28	51	77	195	37	249	155	209	63	23	23	18	23
29	39	9.4	213	24	------	164	202	46	25	23	14	23
30	39	68	191	17	------	143	184	47	27	23	14	23
31	5.4	------	132	23	------	146	------	44	------	21	18	------
TOTAL	880.1	850.7	1,952.1	1,355	3,317.8	5,095	4,726	2,240	1,536.1	739	567.1	638
MEAN	28.4	28.4	63.0	43.7	118	164	158	72.3	51.2	23.8	18.3	21.3
MEANt	27.8	29.7	66.3	40.0	122	163	158	70.9	50.2	22.8	18.3	21.3
CFSMt	.326	.348	.777	.469	1.43	1.91	1.85	.831	.589	.267	.215	.250
INt	.38	.39	.90	.54	1.49	2.20	2.06	.96	.66	.31	.25	.28

CALENDAR YEAR 1964 MAX 546 MIN 2.5 MEAN 101 MEANt 101 CFSMt 1.18 INt 16.10
WATER YEAR 1964-65 MAX 313 MIN 2.2 MEAN 65.5 MEANt 65.4 CFSMt .767 INt 10.42

* Discharge measurement made on this day.
† Adjusted for change in contents in Buffumville and Hodges Village Reservoirs.
a No gage-height record.
Note.--Discharge in cubic feet per second per square mile and runoff in inches may not represent natural flow because of regulation.

PLATE 3



NOTES:

1. OBSERVED 1965 FLOWS AT WEBSTER ARE SHOWN ON PLATE 4.
2. REDUCED WEBSTER FROM 22 C.F.S. TO 20 C.F.S. DUE TO POOL STAGE DROPPING BELOW MINIMUM STAGE CURVE.

WATER RESOURCES DEVELOPMENT PROJECT

THAMES RIVER BASIN
HODGES VILLAGE DAM
1965 SAMPLE OPERATION
LOW FLOW AUGMENTATION
22 C.F.S. AT WEBSTER

NEW ENGLAND DIVISION, WALTHAM, MASS.
FEBRUARY 1978

PLATE 4

C. GEOTECHNICAL CONSIDERATIONS

HODGES VILLAGE LOW-FLOW AUGMENTATION STUDY

STAGE II

GEOTECHNICAL CONSIDERATIONS

US Army Corps of Engineers
New England Division
Engineering Division
Geotechnical Engineering Branch
Waltham, Massachusetts 02254
February 1982

HODGES VILLAGE LOW-FLOW AUGMENTATION STUDY

STAGE II

GEOTECHNICAL CONSIDERATIONS

HODGES VILLAGE LOW-FLOW AUGMENTATION STUDY

STAGE II

GEOTECHNICAL CONSIDERATIONS

1. Topography. The Hodges Village Dam and Reservoir is situated in the French River Valley, approximately one mile west of Oxford, Massachusetts. This valley is located in the New England upland section, near the western edge of the seaboard lowland section of the New England physiographic province. The topography of the region is of low to moderate relief with elevations generally ranging from 450 to 900 feet NGVD (National Geodetic Vertical Datum). The French River Valley is an ancient, pre-glacial valley which was filled with stratified glacial drift as the Pleistocene glaciers receded. The surface landforms consist of a complex of kames and kettles, kame terraces, kame plains, deltas, and a variety of other ice-contact features. Outwash plains also represent a small portion of the total deposition in the area.

2. Site Geology. The bedrock along the dam site varies from a finely-crystalline, mica schist on the area of the right abutment to a granite-gneiss along the valley bottom. The bedrock depth at the dam site varies from outcrops or near surface on the right abutment to over 100 feet below the existing valley floor on the left side of the valley. The overburden in the vicinity of the dam consists of slightly silty sands and gravels which were deposited as outwash by the receding Pleistocene glaciers. Till generally blankets the hills and ridges except for some of the upper slopes where rock is exposed.

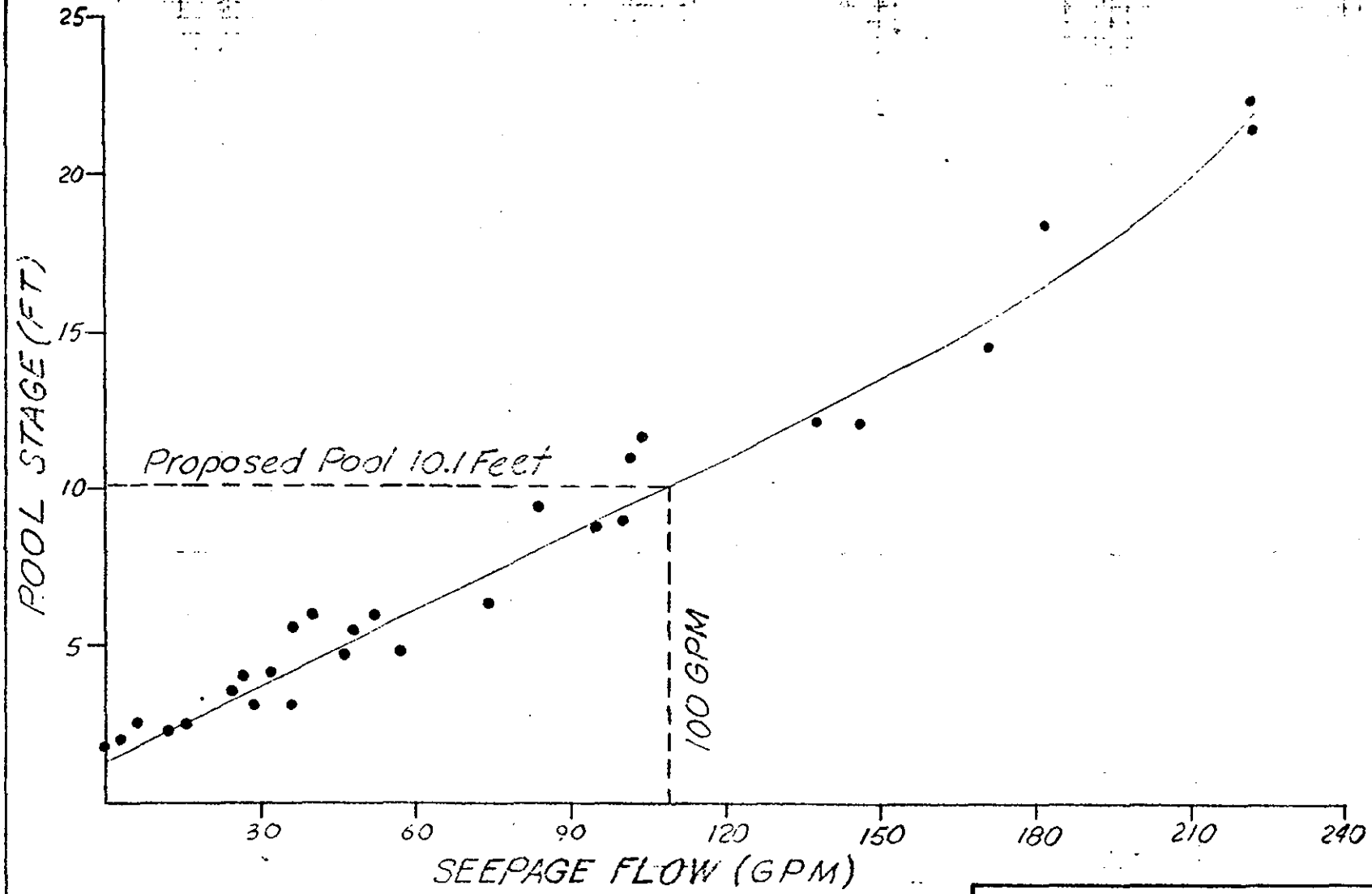
3. Foundation Conditions. The conditions by the downstream toe and the old river channel are defined by some of the original foundation explorations for Hodges Village Dam. Bedrock at the site grades from a quartz-mica schist to a phylitic gneiss. The rock lies under 17 to 45 feet of overburden, and consequently, the proposed concrete measuring weir will not be founded on rock. The overburden at the site will provide a suitable foundation for the proposed measuring weir. Silty, gravelly sands and silty, sandy gravels with occasional boulders will be found under up to two feet of topsoil and organic material. This soft material will be stripped in the area of construction, but no other foundation preparations are considered necessary. Groundwater will be found within three to twelve feet of the ground surface. The actual level will vary depending on the fluctuations of the river water level. Some type of dewatering will be required for construction of the measuring weir.

4. Seepage Conditions.

a. Seepage flow emerges from the downstream toe of the dam in the vicinity of the old river channel creating an area of standing water eight to ten inches and extending 150 feet along the toe. Flow is clear and there is no evidence of any internal erosion (piping) of embankment material. Evidence to date indicates that the flow is the result of seepage through the dam foundation and embankment. The rate of observed seepage flow is higher than anticipated in design indicating that the permeabilities of the foundation soils and the effects of their stratification were underestimated. No foundation cut off or

upstream impervious blanket was incorporated into the design of the dam. It is believed that the recommended seepage control measures, a rock fill berm and filling and regrading of the area downstream of the dam, will be adequate to ensure the future integrity of the dam with the proposed permanent pool level.

b. A temporary plywood V-notch weir and earth dike were installed downstream of the dam to measure this seepage in April 1977. Periodic readings were recorded of seepage versus pool stage from April 1977 to February 1979. The graph on Plate No. C-1 shows the relationship between seepage flow and pool stage. Readings were discontinued due to deterioration of the temporary measuring weir and dike.



NOTE:
ZERO Stage = 455.5 feet N.G.V.D.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY TB	HODGES VILLAGE DAM
DR. BY JGD	LOW FLOW AUGMENTATION STUDY
CK. BY EB	POOL STAGE VS. SEEPAGE FLOW
GEOTECH. ENG. BR.	SCALE: AS NOTED

PLATE C-1

D. PERTINENT DATA

THAMES RIVER FLOOD CONTROL PROJECT

HODGES VILLAGE DAM, MASSACHUSETTS

Condition of Improvement, 30 September 1976

Summarized Data

Location: The dam is on the French River 15 miles above its confluence with the Quinebaug River in the Town of Oxford, Massachusetts.

Authorization: The project was authorized by the Flood Control Act of 1941.

Purpose: The project provides for the construction of a rock and earth fill dam providing reservoir storage for flood control.

Reservoir:

Counties affected: Worcester

Operating levels:

Pool	Elevation of Pool	Capacity (Acre-Ft.)	Area (Acres)
Invert	465.5		
Minimum	465.5		
Seasonal	-		
Flood Control	465.5-501	13,250	740
Total Storage	501	13,250	740

Drainage Area:

Drainage area above dam - 31.1 square miles

Dam:

Type	Rock and earth fill
Maximum Height	55 feet
Length	2,050 feet
Quantity of fill	282,400 c.y.

Included in project are 4 earth dikes necessary for closing saddles in reservoir perimeter. The 4 dikes have a total length of 2,600 feet and maximum height of 35 feet.

Spillway: Chute-type, with ogee weir, 145 feet in length with crest elevation 501. Discharge capacity is 25,800 c.f.s.

Outlet Works: Two rectangular conduits, 5 feet by 6 feet and 206 feet in length with two 5'x6' electrically-controlled slide gates.

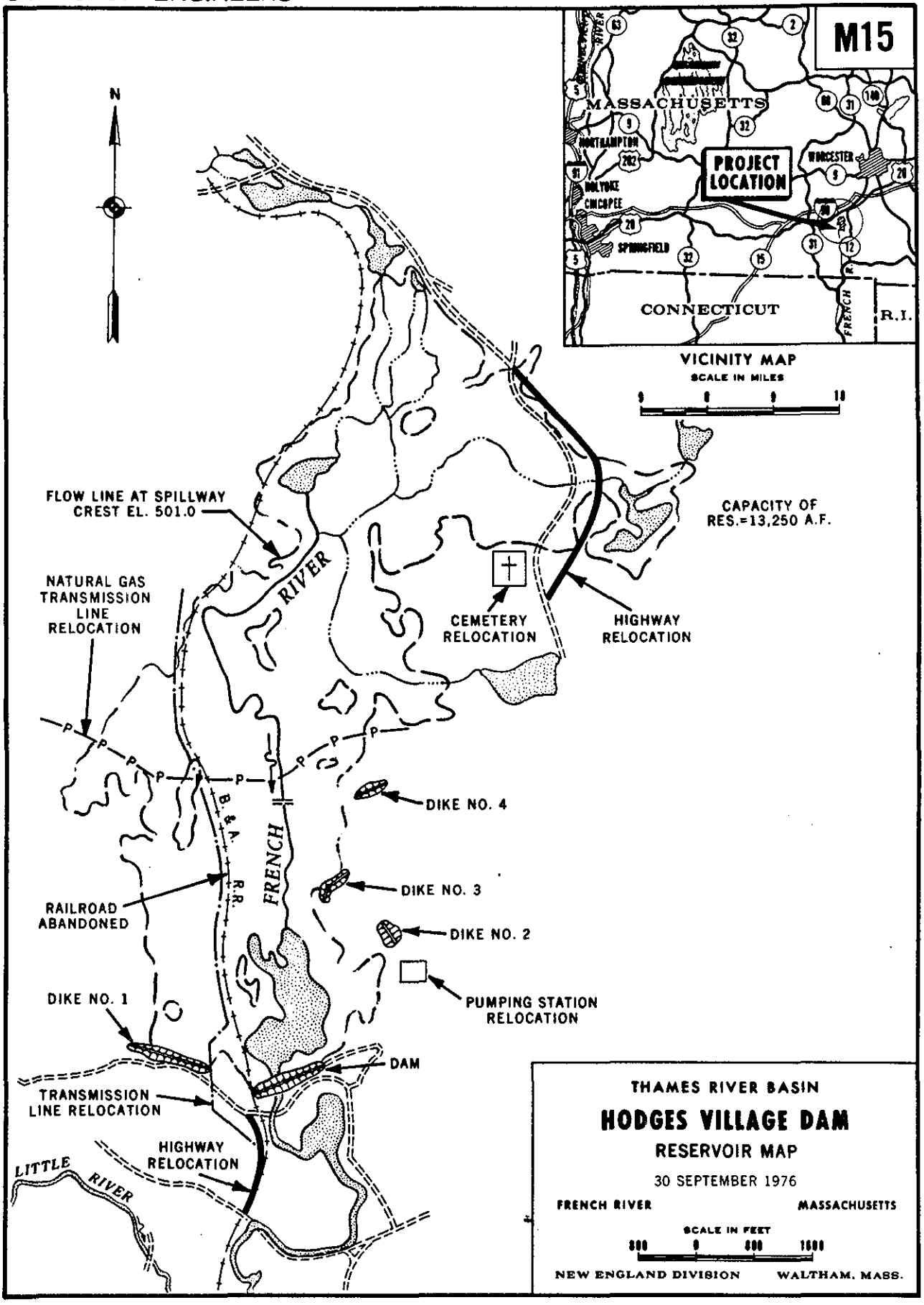
Relocations: Highway, railroad and transmission line relocated.

Progress: Project is complete. Construction of dam and appurtenances was initiated in March 1958, completed in December 1959.

Cost Data: Cost of completed work was $1,277,000 for construction and $3,144,000 for lands and damages including highway, railroad and utility relocation, a total of $4,421,000.

CORPS OF ENGINEERS

U. S. ARMY



THAMES RIVER BASIN

HODGES VILLAGE DAM

RESERVOIR MAP

30 SEPTEMBER 1976

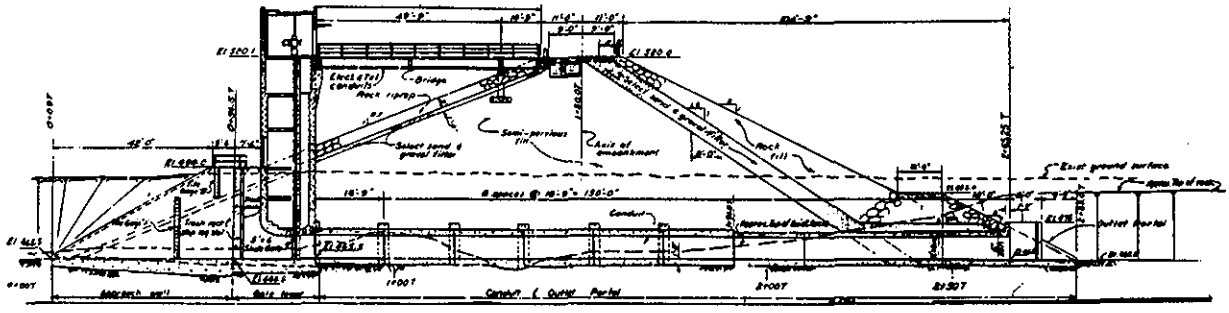
FRENCH RIVER MASSACHUSETTS

SCALE IN FEET

NEW ENGLAND DIVISION WALTHAM, MASS.

CORPS OF ENGINEERS U. S. ARMY

M15a



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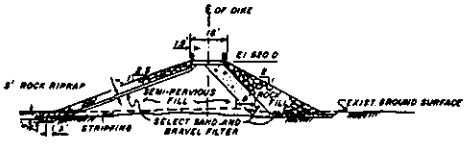

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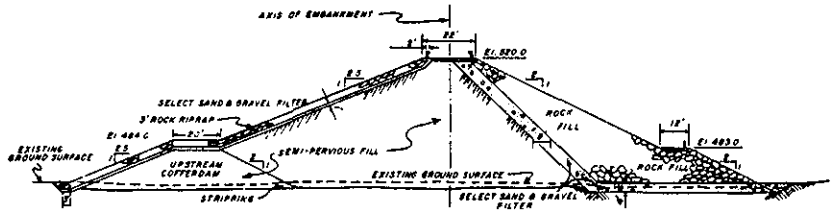

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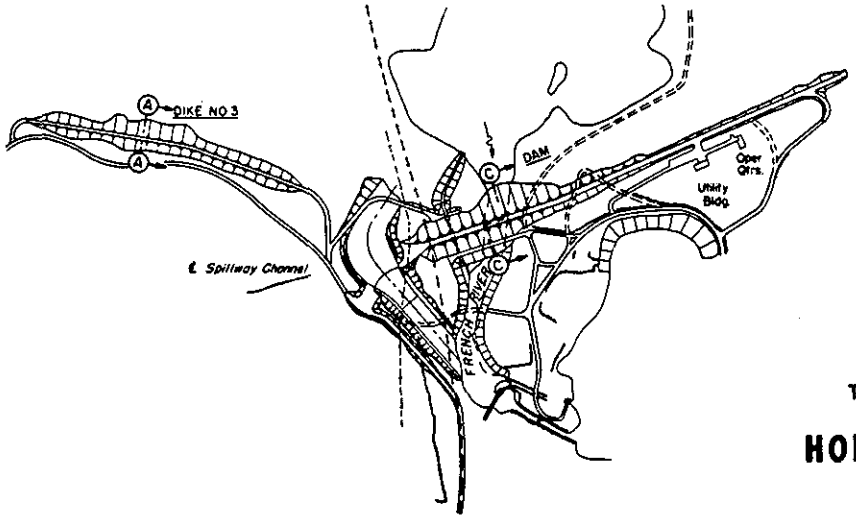

THAMES RIVER BASIN

HODGES VILLAGE DAM

GENERAL PLAN

30 SEPTEMBER 1976

FRENCH RIVER MASSACHUSETTS

NOT TO SCALE

NEW ENGLAND DIVISION WALTHAM, MASS.

INCLOSURE 2

PROJECT INFORMATION BROCHURE

US Army Corps
of Engineers
New England Division

Project Information

424 Trapelo Road, Waltham, Massachusetts 02254

MODIFICATION OF HODGES VILLAGE DAM AND RESERVOIR

OXFORD, MASSACHUSETTS

FEBRUARY 1982

This fact sheet was prepared to assist local officials and concerned citizens in achieving a better understanding of the Corps' role in the Federal and State effort to improve the water quality of the French River. It is hoped that this fact sheet will aid in public discussion and result in timely citizen participation in the study. As this is a preliminary publication, its contents are subject to change as a result of further analysis and study. Additional information may be obtained by contacting:

Project Manager: Richard Heidebrecht Telephone: (617) 894-2400 X547

Public Affairs Contact: Larry Grossman (617) 894-2400 X777

MODIFICATION OF HODGES VILLAGE DAM & RESERVOIR

U.S. ARMY CORPS OF ENGINEERS

NEW ENGLAND DIVISION

WALTHAM, MA

The primary objective of this study is to investigate the feasibility of modifying the operation and structural element of the completed Federal project to provide low flow augmentation for water quality improvement in the French River downstream of Hodges Village Dam. We will also investigate other water resource needs at the project, including recreation, fish and wildlife management and other related needs that may arise as the study progresses.

EXISTING PROJECT AND CONDITIONS

The Hodges Village Dam and Reservoir is a single purpose flood control project located in the upper Thames River Basin, on the French River in the town of Oxford, Massachusetts. The dam site is about 10 miles south of Worcester, Massachusetts. Completed in 1959, the reservoir has a storage capacity of 13,250 acre feet, which is equivalent to 8.0 inches of runoff from its drainage area of 31.1 square miles. The top of the dam is 55 feet above the riverbed and approximately 2.050 feet in length. The spillway weir is 125 feet long at a crest elevation 36 feet above the riverbed. A plan showing the pertinent features of the existing project is attached.

Since the completion of the project there have been major reductions in flood damages at Webster and Dudley, Massachusetts and Thompson, Connecticut. In addition, flood damages are materially reduced at communities extending from Putnam, Connecticut, on the Quinebaug River, downstream to Norwich, on the Thames River. Flood damages prevented through September 1981 amount to $11,520,000.

Unrelated to the flood control project, the French River has a serious water quality problem downstream of the dam. Existing water quality data indicate that the river below Webster and Dudley turns septic during high temperature and low stream flow periods. Also, there is a long history of complaints of bad odor and high coliform concentrations during summer months by residents of downstream communities in the vicinity of Putnam and Thompson, Connecticut.

BACKGROUND

In a letter dated 2 October 1970, the Director of the Massachusetts Water Resources Commission requested the Army Corps of Engineers to examine the feasibility of utilizing reservoir storage in the Hodges Village project to provide low flow augmentation for water quality improvement in the French River.

The U.S. Environmental Protection Agency (EPA) determined that treatment levels exceeding best available and economically achievable control technology would be required in order to secure Congress's water quality goal of fishable, swimmable water by 1983. In a letter to the Corps, dated 30 December 1975, EPA recommended that the Corps of Engineers undertake

feasibility studies on providing stream flow regulation for water quality control from the Hodges Village Reservoir.

On 9 July 1976, Congressman Christopher J. Dodd, 2nd District, Connecticut, requested that the Corps undertake a study to provide low flow augmentation for the French River to relieve its waste treatment problems.

In response to these requests, studies were initiated in October of 1976 under the authority provided by Section 216 of the 1970 Flood Control Act, Review of Completed Projects. Studies proceeded until August of 1979 when they were postponed pending final indorsement of low flow augmentation by the EPA as a necessary measure for water quality purposes. Based on the findings of an evaluation of wastewater problems in Webster and Dudley, the EPA has now indorsed the need for low flow augmentation. This resulted in reactivation of our study in November 1981.

LOW FLOW AUGMENTATION PLAN

The plan now under consideration consists of the creation of a seasonal impoundment at Hodges Village Reservoir and Dam to provide a flow of not less than 22 cfs (about 10,000 gallons per minute) at the French River stream gage in Webster during the months of June through October. Modifications to Hodges Village Dam and Reservoir would consist of clearing woody vegetation and selective stripping of organic topsoil in the reservoir area to be inundated, and modifying one of the outlet gates at the dam.

DESIGN CRITERIA

The project was designed to complement other water quality efforts in achieving Class B standards[1] for the French River. EPA has determined that effluent limits, from upgraded waste treatment plants in Webster and Dudley, at natural low flow marginally meet Class C standards[2] but are inadequate for Class B standards. At a streamflow augmented to 22 cfs the water quality in the French River would meet Class B standards.

FISH AND WILDLIFE

To determine the impact of project modification on fish and wildlife resources, coordination has been maintained with the U.S. Fish and Wildlife Service. Mitigation measures will be developed, as required, to offset negative impacts to these resources.

A general plan for fish and wildlife management covering Hodges Village Dam and Reservoir was established in 1963 by joint agreement of the Secretary of the Army, Secretary of the Interior and the Director of the Massachusetts Division of Fisheries and Game. Meetings with the Massachusetts Division of Fish and Game and the U.S. Fish and Wildlife Service will be coordinated with the Corps to discuss the relationship between that plan and the proposed low flow augmentation project now under consideration.

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(1) Class B waters are suitable for bathing and other recreational uses, certain industrial processes and cooling, provide excellent fish and wildlife habitat, and have good aesthetic value.

(2) Class C waters are suitable for certain fish and wildlife habitat, recreational boating, and certain industrial processes and cooling.

ECONOMICS

At the point of deferral in 1979, the total first cost of the proposed modifications was estimated at $2 million. At that time, our investigation indicated that seasonal storage to provide low flow augmentation for water quality improvement was both technically and economically feasible. Project costs and benefits are currently being updated.

PROJECT IMPACTS

Clearing and stripping will have a significant impact on the present reservoir area and its wetlands. The two town leased reservoir recreation areas and the Massachusetts Wildlife Management area within the reservoir will be impacted by the reservoir clearing and stripping and by new seasonal pool fluctuations. Allocating reservoir storage sufficient to provide a flow of 22 cfs at the gage in Webster from June to October would not infringe upon the reservoirs flood control capabilities.

Low flow augmentation permits the achievement of the 1983 Class B standards. It may also provide intangible benefits downstream of the project, including: (1) high stream velocities which will inhibit undesirable aquatic growth, (2) additional dilution of noxious or nondegradable wastes and (3) dilution of waste from non-point sources not easily amenable to collection and treatment.

PUBLIC INVOLVEMENT

Meetings will continue to be held with Federal, State and local officials to inform them of the need for the project and related potential impacts. At the present time, Oxford officials have indicated concern for the impact

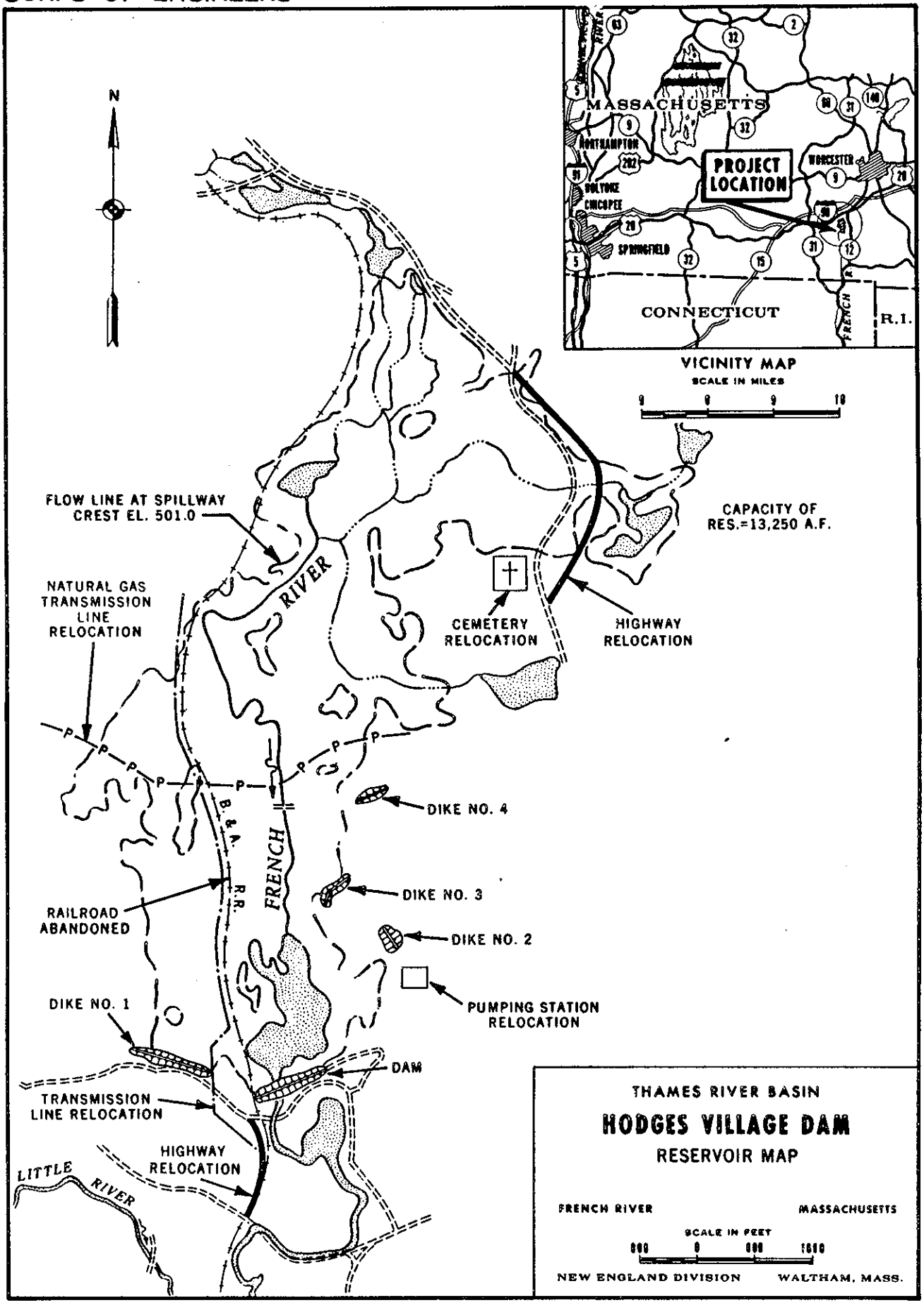
that clearing and stripping may have on aesthetics and recreation resources of the reservoir. These and any other concerns that become evident will be addressed during the study.

CONCLUSION

All investigations to this point emphasize the need for low flow augmentation in the French River. The study has shown that low flow augmentation from Hodges Village Dam and Reservoir is technically and economically feasible. Support for such a plan has been indicated by the EPA, the Massachusetts Water Resources Commission, and Congressional interests.

CORPS OF ENGINEERS

U. S. ARMY



INCLOSURE 3

PERTINENT CORRESPONDENCE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION I

J. F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

March 4, 1982

Mr. Joseph L. Ignazio, Chief
Planning Division
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Mr. Ignazio:

As requested by the Corps of Engineers, we have calculated water quality benefits attributable to the Hodges Village low flow augmentation project. If a continuous flow of 22 cfs is maintained at the USGS gage in Webster, the projected annual savings in wastewater treatment cost is approximately $930,000. This is based on May, 1981, costs (ENR Index = 3470) and a discount rate of 7 5/8%. Calculations for these costs are shown on the attached worksheet.

As you are aware through your active participation on the Working Group on Interstate Transport of Pollutants, the provision of low flow augmentation and Advanced Treatment alone will not meet the water quality standards on the French River. Oxygen demanding sludge deposits in the five impoundments between Webster and the confluence with the Quinebaug River must be removed or somehow inactivated to allow for full recovery of the French River. However, the combination of Advanced Treatment and low flow augmentation will result in a significant improvement in water quality. Based on the water quality and cost analyses, we believe that low flow augmentation is an environmentally and economically sound proposal.

Sincerely yours,

Richard P. Kotelly, Acting Director
Water Division

attachment

cc: Russell A. Isaac, MDWPC
Robert Smith, CT DEP
Alfred Peloquin, NEIWPCC

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

February 25, 1982

C. E. Edgar III, Colonel
Department of the Army
New England Division, Corps of Engineers
424 Tropelo Road
Waltham, Massachusetts 02154

Re: Hodges Village Dam

Dear Colonel Edgar:

We have received a copy of your letter of January 15, 1982 regarding Hodges Village Dam. Naturally we are very pleased to learn that progress is being made with regard to this project. As you know, our staff has supported continuing this study and views it as a key element in solving the water quality problems in the French River. It is unfortunate that this study has been delayed so long and now that you are able to proceed, we urge you to complete the study as quickly as possible.

Thank you for informing us of the status of this project and we look forward to reviewing the report when it is done.

Very truly yours,

Stanley J. Pac

Stanley J. Pac
Commissioner

SJP:RLS:mg

Phone:

State Office Building, Hartford, Connecticut 06115

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

October 22, 1981

Colonel C.E. Edgar, III
Division Engineer, New England
Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Colonel Edgar:

As part of a combined Federal/State effort to restore fishable, swimmable water quality in the French River in Massachusetts and Connecticut, our Agency has been working with your office regarding low flow augmentation from Hodge's Village Reservoir in Oxford, MA. Currently, water quality standards are not met in the French River due to municipal and industrial wastewater discharges compounded by years of sediment buildup in several impoundments in Massachusetts and Connecticut. The high cost of attaining standards solely through treatment of Webster's and Dudley's discharges has led the Towns, the States, and EPA to search for less costly, alternative solutions. To this end, the Towns have hired a consultant to investigate all possible treatment alternatives while Massachusetts and Connecticut are examining ways of dealing with the instream sludge deposits. At the same time, your staff initiated a feasibility study of providing low flow augmentation from the existing Corps of Engineers reservoir.

Prior to this point, the New England Division office has proceeded as far as possible with the Hodge's Village low flow augmentation feasibility study pending endorsement of the project by EPA as being necessary for water quality purposes. Based on information recently received from the engineering consultants to Webster and Dudley, we can now endorse low flow augmentation for the French River. The towns' consultant has informed us that land application of the treated wastewater is not feasible meaning there will be continued discharges to the French River necessitating several actions if water quality goals are to be secured. Low flow augmentation, in addition to advanced treatment at the discharge and downstream sediment removal or inactivation, will all be necessary to insure acceptable water quality in the future.

We hereby request that your office take the necessary steps to continue and complete the low flow augmentation feasibility study for Hodge's Village.

We are currently preparing a cost analysis for wastewater treatment with and without augmentation. As soon as these figures are available, we will forward them to you for use in the benefit/cost analysis. If you have any questions, please feel free to contact me or Eric Hall of my staff. We look forward to working with you towards the successful completion of this project.

Sincerely yours,

Charles W. Murray, Jr., Director
Water Division

cc: Thomas McMahon, DWPC
Robert Moore, CT DEP
Peter Jackson, COE
Thomas K. Walsh, Metcalf & Eddy
Gregory Barnes, Marullo & Barnes

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

September 27, 1979

Max B. Scheider, Colonel
Army Corps of Engineers
Division Engineer
424 Trapelo Road
Waltham, MA 02154

Dear Colonel Scheider:

We have reviewed, with representatives of the Massachusetts and Connecticut water pollution control agencies, your decision of August 1, 1979 to defer the Corps' Hodges Village Low Flow Augmentation study. At this time we would like to reiterate our request contained in our May 16, 1979 letter to Colonel Chandler. We requested, in May, that the Corps set aside the necessary funding to complete the study since we continue to place a high priority on the clean-up of the French River and believe there is a high potential for low flow augmentation to be part of the solution. We understand that Stages 1 and 2 are complete but Stage 3, primarily the environmental review and detailed cost estimation, has yet to be initiated.

Webster and Dudley have recently contracted with Metcalf and Eddy, Inc. to prepare a facilities plan to determine the most cost-effective means of achieving and consistently maintaining water quality standards in the French River. Concurrently, EPA and Massachusetts are taking enforcement actions against Webster and Dudley to accelerate the clean-up process. Given the high priority Connecticut and Massachusetts attach to the French River and the current level of engineering and legal activity, we would appreciate re-consideration of your decision to defer the low flow study. We and the States believe that if the Corps completes the Stage 3 report concurrently with the Webster and Dudley facilties plan, potential delays in the construction of the Hodges Village modifications, if necessary, will be eliminated.

By a separate letter dated September 20, 1979 you and your staff have been invited to a meeting on October 3, 1979 in EPA offices to discuss the many aspects of the French River restoration. We would appreciate it if the Corps could have a response to our request at this meeting. If you have any questions please feel free to contact Richard Kotelly of my staff at 223-5633.

Sincerely yours,

William R. Adams, Jr.
Regional Administrator

cc: S. Pac, R. Moore, R. Smith - CT DEP
A. Cortese, T. MacMahon - MA
A. Peloquin - NEIWPCC
L. Carothers - Enforcement Branch, EPA
C. Ciriello - Corps of Engineers

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

September 20, 1979

Colonel Max B. Scheider
Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Colonel Scheider:

I would like to invite you to participate in the first meeting of the the Regional work group on the Interstate Transport of Pollutants. This first meeting has been scheduled for October 3, 1979, at 10:30 a.m. at the JFK Building in Boston, MA. The interstate transport of pollutants has been identified as a high priority issue of the State of Connecticut and EPA in the State/EPA Agreement (SEA) (copy attached). It is an important water pollution control issue that will require the active participation of various state and federal agencies including: EPA Region I and Region II, New York, Massachusetts, Connecticut, the Corps of Engineers, and the New England Interstate Water Pollution Control Commission.

Since a great deal of effort has already been focused on the French and Quinebaug Rivers in Massachusetts and Connecticut, the morning session will concentrate on these Rivers. The afternoon session will initiate discussion on the Housatonic River (Massachusetts and Connecticut) and the Ten Mile River (New York and Connecticut).

The tentative agenda for this meeting on the interstate transport of pollutants is included as Attachment #1. (Proposed discussion leaders are also listed.) If you have any questions or comments, please feel free to contact Richard Kotelly at 223-5633, or William Nuzzo or Eric Hall at 223-5130.

I look forward to your participation.

Sincerely yours,

William R. Adams, Jr.
Regional Administrator

attachments

cc: Peter Jackson

ATTACHMENT #1

Tentative Schedule October 3, 1979

Regional Working Group on the Interstate Transport of Pollutants

Morning Session - 10:30 - 12:00

1. Welcoming remarks - EPA - William R.Adams, Jr., Regional Administrator; Charles W. Murray, Jr., Director, Water Division

2. Status Report of EPA Actions and Activities of French River Task Force - EPA - Richard Kotelly, Deputy Director, Water Division; Eric Hall,

3. a.) Enforcement Actions - EPA - Leslie Carothers, Director, Enforcement Division; Richard Cavagnero

   b.) Enforcement Actions - Massachusetts - William Slagle

4. Facilities Construction - EPA - Anthony DePalma, Chief, Massachusetts Facilities Planning Section

   Massachusetts -- Robert Cady

5. Low Flow Augmentation - Corps of Engineers - Peter Jackson

6. Strategy for Eliminating In-Place Pollutants - Connecticut -- Robert Moore

BREAK - LUNCH

Afternoon Session - 1:00 - 2:30

1. Status Report on Housatonic Water Quality Study - EPA -- Eric Hall

   Massachusetts -- Paul Hogan

2. Housatonic River Basin Planning and Wasteload Allocations - Massachusetts - Paul Hogan

3. Report on Algae Problems in Housatonic Impoundments - Connecticut -- Robert Smith

4. Report on Connecticut P-Removal Strategy - Connecticut -- Robert Smith

5. Preliminary Discussion of Strategy for Eliminating the Phosphorus Problem in the Housatonic River.

6. Preliminary Discussion of Strategy for Ten Mile River and Class AA Water Quality Standards in Interstate Watersheds - (New York-Connecticut)

Hodges Village Dam. The State of Connecticut and the Commonwealth of Massachusetts have agreed to certain conditions as set forth in the statutes.

If there are any changes contemplated in the function of the Hodges Village Dam, any present agreements between the State of Connecticut and the Commonwealth of Massachusetts would have to be reviewed. Mr. William Wise, 37 Bishop Road, West Hartford, Connecticut, is a member of the Thames River Valley Flood Control Commission to whom correspondence may be addressed. The Department of Environmental Protection's Water Resources Unit and Water Compliance Unit have regulatory authority in these matters and also should be informed of all developments.

We appreciate the Corps' efforts in conducting this study.

With best wishes,

Cordially,

Ella Grasso

ELLA GRASSO
Governor

INTERSTATE TRAVEL OF POLLUTANTS

Description of Issue

Several interstate rivers in Connecticut receive pollutant loads from Massachusetts and New York causing water quality problems. Specifically, organic loads from Dudley and Webster, Massachusetts, affect the French River; PCB and phosphorus loads from the Pittsfield area in Massachusetts affect the Housatonic; and phosphorus loads from New York State affect the Ten Mile River and the Housatonic. Additionally, preservation of Connecticut's Class AA (water supply watersheds) water quality standards in interstate watersheds is essential. Technical information must be disseminated to the various State and Federal officials involved, and EPA Region I will take a lead role in coordinating and managing the input and participation of Massachusetts, New York, EPA Region II and the New England Interstate Water Pollution Control Commission.

Work Plan

1. On or before October 31, 1979 - EPA will arrange a meeting with Federal, State, interstate, and local officials involved with the French River cleanup. EPA will provide a status report of their actions and activity of the French River Task Force. Discussion will center on enforcement of a timely schedule for submission of necessary engineering work and construction of the needed facilities, and on Connecticut's strategy for eliminating in-place pollutants in the impoundments.

2. On or before October 31, 1979 - EPA will arrange a meeting with officials involved with phosphorus removal from discharges to the Housatonic River.

   a) EPA will provide a status report on the study done by the State of Massachusetts, the State of Connecticut, and EPA during the summer of 1978.

   b) Connecticut will provide an update of the continuing study of algae problems in impoundments in the Housatonic River.

3. December 1, 1979 - First Quarterly Meeting

EPA will arrange a meeting with appropriate officials. Discussion will be centered on the following issues:

a) EPA will provide status report on the Dudley and Webster issue.

b) EPA will provide status report on the Pittsfield phosphorus issue.

c) DEP will provide status report on Connecticut's phosphorus control program. An update of phosphorus loading from Connecticut, including nonpoint source information from the 303(e) and 208 planning efforts will be presented.

d) DEP will provide status report on Connecticut's PCB study on the Housatonic River.

e) EPA and States will discuss strategy for eliminating phosphorus problem in the Housatonic.

f) EPA will request attendance of a representative from Region II familiar with phosphorus loadings to the Ten Mile River and the issue of Class AA standards for New York State waters tributary to Connecticut drinking water supplies.

g) Interstate pollution problems with respect to the Connecticut River will be discussed in general.

4. March 1, 1980 - Second Quarterly Meeting

a) Continued discussion and presentation of status reports.

b) Connecticut will provide strategy for eliminating or reducing in-place pollutants in French River impoundments.

c) Connecticut and EPA will prepare preliminary listing of sampling and modeling needs to complete the French River and Housatonic River analyses.

d) EPA will present draft strategy in conjunction with Massachusetts and Connecticut officials for eliminating phosphorus problems in the Housatonic River.

5. June 1, 1980 - Third Quarterly Meeting

a) Continued discussion and presentation of status reports.

b) Revise and finalize strategy for Housatonic River.

6. September 1, 1980 - Fourth Quarterly Meeting

a) Continued discussion and presentation of status reports.

Note: EPA will arrange time and place of all quarterly meetings.

EPA Resources to Assist State

EPA will provide the necessary management level input and enforcement to assure that the appropriate action is taken to correct the particular pollution problems - 0.5 work years.

State Resources

DEP will provide management and technical input. Technical staff will be evaluating water quality problems and treatment needs while managers will cooperate with EPA in reaching a satisfactory conclusion and reporting to those concerned parties in Connecticut.

Funding Source

State General Fund and 106, 208, 314, 201, and 205(g) program grants.

Project Managers

1. EPA Project Manager - William W. Nuzzo (617) 223-5134

2. State Project Manager - Robert L. Smith, P.E.

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
100 Cambridge Street, Boston 02202

Anthony D. Cortese, Sc.D.
Commissioner

September 17, 1979

Max B. Scheider, Colonel
Corps of Engineers
Department of the Army
424 Trapelo Road
Waltham, Massachusetts 02154

Re: Low-flow augmentation
Studies to improve
Water quality at
Webster and Dudley in
The French River

Dear Colonel Scheider:

I was asked to respond to your letter of August 2, 1979 which was sent to Governor Edward King, Secretary John Bewick and my office.

I would like to thank you for keeping us informed of your ongoing low-flow augmentation studies in the French River.

Presently, my staff at the Division of Water Pollution Control (DWPC) and engineers at the USEPA are reviewing a Plan of Study (POS) for a Step 1-Facilities Planning Grant which was submitted to the agencies from the Towns of Webster and Dudley. Both DWPC and USEPA expect to complete their review shortly and the consultant, Metcalf & Eddy, Inc., as engineers for both Towns, will proceed with an estimated fourteen month long facilities planning study based on the approved POS. The consultant will evaluate numerous waste treatment management techniques in order to achieve water quality standards in the French River.

If a biological wastewater treatment scheme followed by a stream discharge is found to be cost-effective, publically accepted and environmentally sound, then low-flow-augmentation must be considered for improved water quality. In fact, Metcalf & Eddy must utilize the waste load allocation of 1,000 lbs/day of Total Oxygen Demand as an effluent limitation when developing a biological wastewater treatment-stream discharge alternative. This allocation was based on a seven day ten year low flow of 22 cfs, which assumes low flow augmentation from the enlarged Hodges Village reservoir. This allocation resulted from DWPC Studies which showed that with advanced wastewater treatment (AWT) technology and a present seven day ten year low flow of about 15.4 cfs in the French River there would continue to be problems in the stream. Thus, additional stream flow is necessary and justifiable and 22 cfs plus AWT will result in acceptable water quality in the stream as depicted in the DWPC's water quality simulation model of the French River. It is assumed that your studies can be reactivated and final planning on the reservoir enlargement initiated when and if a treatment and discharge alternative is approved.

We expect close cooperation between all parties concerned with this facilities planning, e.g., Towns of Webster and Dudley, Metcalf & Eddy, Corps of Engineers, the New England Interstate Water Pollution Control Commission, USEPA, the Massachusetts Division of Water Pollution Control and the Connecticut Department of Environmental Protection. It is noteworthy that Dudley and Webster have joined together for this facilities planning and this union is almost certain to produce a long awaited solution to the unbearable odors being released from the French River and its numerous impoundments.

During facilities planning, we will look forward to working with you and your staff on the proposed Hodges Village Dam and Reservoir enlargement because of the tremendous environmental benefits it will produce.

Thank you for keeping us informed of your studies and we are looking forward to working with you on this vital interstate project in the French River Basin.

Very truly yours,

Anthony D. Cortese, Sc.D.
Commissioner

ADC/RMC/rew

cc: The Honorable Edward J. King, Governor, State House, Boston
John A. Bewick, Secretary of Environmental Affairs, Executive Office of Environmental Affairs, 100 Cambridge Street, Boston 02202
William R. Adams, Regional Administrator, U.S. Environmental Protection Agency, Region 1, John F. Kennedy Building, Boston 02203
Thomas C. McMahon, Director, Division of Water Pollution Control, 110 Tremont Street, Boston 02108
John B. Casazza, Deputy Director, Division of Water Pollution Control, 110 Tremont Street, Boston 02108
Alan Cooperman, Associate Sanitary Engineer, Water Quality Section, Division of Water Pollution Control, P.O. Box 545, Westboro 01581
Mr. Alfred Peloquin, New England Interstate Water Pollution Control Commission, 607 Boylston Street, Boston

ELLA GRASSO
GOVERNOR

STATE OF CONNECTICUT
EXECUTIVE CHAMBERS
HARTFORD

August 30, 1979

Colonel Max. B. Scheider
Corps of Engineers
Department of the Army
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Scheider:

Thank you for contacting me about the French River in Massachusetts and Connecticut.

Since this matter is within the jurisdiction of Commissioner Stanley J. Pac, Department of Environmental Protection, I have taken the liberty of forwarding a copy of your letter to him and assure you that this matter will be given careful consideration.

I appreciate your concern and have asked the commissioner to review your comments and respond directly to you. You should receive a reply in the very near future. Please feel free to contact the commissioner regarding any future concerns you might have in this area.

With best wishes,

Cordially,

Ella Grasso

ELLA GRASSO
Governor

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

August 20, 1979

Max B. Scheider
Colonel, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Scheider:

I am shocked by your letter of August 2, 1979 advising me that the Corps of Engineers is deferring the low-flow augmentation studies of the French River. I find it incredible that EPA will not support this most important project that both the State of Connecticut and the Commonwealth of Massachusetts have endorsed.

EPA is certainly constrained by its own rules in funding specific projects and project alternatives, but I cannot understand why they will not support this project which is so important to the Water Quality of the French River and the needs of the people along it. I will do all I can do to reverse EPA's position on this matter.

Please feel free to contact me at any time on this issue. I will keep you advised of any actions this office takes in regard to the project.

Thank you for advising me of the situation.

Sincerely yours,

Stanley J. Pac

Stanely J. Pac
Commissioner

SJP/REM/am

cc: William Adams, Regional Administrator
Christopher J. Dodd

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

June 11, 1979

John P. Chandler, Colonel
Corps of Engineers
Division Engineer
New England Division
424 Trapelo Road
Waltham, MA 02154

Dear Colonel Chandler:

Thank you for your letter of May 16, 1979 regarding the study of potential modifications to Hodges Village Dam and Reservoir to provide low flow augmentation for water quality improvement in the French River. You state in your letter that the Corps of Engineers is prepared to terminate the study unless a clear indication is received from EPA that low flow augmentation will be an integral part of the French River Water Quality Plan. We appreciate your concern for the large number of studies you and your staff are asked to undertake and realize you must establish priorities. We hope the Corps will continue to give the Hodges Village modification a high priority and we request that you set aside the necessary funding to complete the feasibility study.

I would like to clear up two points raised in your letter regarding the EPA position on low flow augmentation. At the April 10, 1979 French River Task Force meeting it was mentioned that Webster and Dudley are operating under EPA Administrative Orders to prepare a facilities plan which will result in the attainment of water quality standards in the French River. Our facilities planning regulations are very specific concerning the development of a cost-effective approach to water quality through a complete and thorough analyses of all alternatives. This will include a detailed anaysis of low flow augmentation from the Hodges Village Dam and Reservoir done concurrently with evaluations of other possibilities such as higher degrees of industrial pretreatment, land application, etc.

Secondly, the Central Massachusetts 208 plan correctly states EPA policy regarding low flow with regard to advanced waste treatment. Until the highest degree of treatment economically feasible for a point source of pollution has been constructed or planned, low flow augmentation cannot, under our present policy, be endorsed by EPA. What the Central Massachusetts 208 plan goes on to say is that low flow augmentation only, in

lieu of any additional treatment at Webster and Dudley, is considered infeasible. The 208 plan goes further to recommend an advanced waste treatment scheme designed to meet waste load allocations that have been determined based on an augmented flow of 22 cfs at Webster gage. A complete cost analysis of the advanced waste treatment works necessary to meet water quality standards even with augmented flows shows a total 1977 present worth of over $9 million. It is for the reason of this extremely high cost that Webster and Dudley, as well as Massachusetts and EPA, wish to examine the situation further to discover a less costly solution.

To summarize, EPA continues to believe that low flow augmentation, in conjunction with advanced waste treatment at Webster and Dudley, will lead to the attainment and maintenance of fishable/swimmable water quality in the Fench River. However, until Webster and Dudley complete the required facilities planning, we cannot assure the Corps of Engineers that low flow augmentation will be the most cost-effective alternative. The facilities plan should be completed within a year of initiation which is expected in July. We hope to work closely with you, the consultants for Webster and Dudley, and the States of Massachusetts and Connecticut in developing a cost-effective plan for the French River which will attain the national water quality goals. I wish to thank you and your staff for all the support you have provided regarding the French River and with your continued assistance I am sure we can satisfactorily resolve this complex issue.

Sincerely yours,

Rebecca Hanmer

for William R. Adams, Jr.
Regional Administrator

The Commonwealth of Massachusetts
Division of Fisheries and Wildlife
Leverett Saltonstall Building, Government Center
100 Cambridge Street, Boston 02202

DIRECTOR

June 8, 1979

Colonel John P. Chandler
Division Engineer
424 Trapelo Road
Corps of Engineers
Waltham, Massachusetts 02154

Dear Colonel Chandler:

This agency has had an opportunity to review and discuss the Hodges Village Dam Low Flow Augmentation Study which the Corps is conducting. It is our understanding that the projects' purpose is to provide dilution to the effluents discharged by the Webster Sewage Treatment Plant and than an augmentation pool would be created by clearing and grubbing, such pool to be filled and stored waters discharged as needed. It is supposed that, at least in some years, the augmentation pool would be drained to its bottom by fall.

From a wildlife agency perspective, the proposal does not look attractive. At least from what we now know, it does not appear that augmentation would have any significant downstream benefits and the elimination of many acres of good habitat (brushland and timbered swamp) for the establishment of a pool would be a net loss to wildlife. Further, the drainage of said pool to an empty basin stage would not be a positive step.

It is our hope that the Corps will not proceed to develop this project as currently perceived. Our representatives have previously suggested to the Corps that consideration be given to impoundment of water for waterfowl production but we were told that the idea would run counter to the project's purpose, flood control. Perhaps a plan can be developed that would provide real fish and wildlife benefits without diminishing augmentation efforts if they are shown to be necessary. To this end, our staff would be pleased to work cooperatively with the Corps. Please let us know if we can be helpful.

Very truly yours,

Matthew B. Connolly, Jr.
Director

MBC:PSM/cms
cc: William C. Ashe, USFWS
Carl Prescott, District Manager

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
One Gateway Center, Suite 700
NEWTON CORNER, MASSACHUSETTS 02158

10 MAY 1979

Colonel John P. Chandler
Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Chandler:

This is in response to Mr. Ignazio's April 20, 1979, letter to Gordon Beckett and your request to me of April 24, 1979, concerning the Hodges Village Dam low flow augmentation study your office is conducting. We note that you would like to "amend our present contract" in order to complete the mitigation plan in July 1979. We accept that Mr. Ignazio was referring to the FY-79 transfer funding agreement between our respective agencies since, to our knowledge, we do not have contracts with your office.

We believe that it would be premature for this Service to start developing a mitigation plan for the low flow augmentation project at this time. There are a number of reasons which cause us to take this posture. As Mr. Beckett indicated in his April 10, 1978, letter, a considerable amount of information needs to be collected to enable this Service to fully evaluate the total impacts of this project.

We believe it is important to take a holistic view of the overall water quality situation in the French River. The draft 208 water quality management plan for this region of Massachusetts is due to EPA this June. However, we understand that the portion for the Webster-Dudley area will be missing because it is currently under restudy by the two towns and may not be available for 6-8 months. Apparently, the initial water quality management study for Webster-Dudley area did not investigate alternatives to standard sewage treatment plants very thoroughly. It is our understanding that the major water quality problems for the French River are directly attributal to two local industries; one each in Webster and Dudley and the sewage treatment plants in the respective towns. We also understand that if these industrial discharges are cleaned up or eliminated, that the French River immediately downstream of the Webster-Dudley area could meet Class "B" standards with some modification to the existing wastewater treatment plants.

The relationship between the dams and sludge deposits further downstream from Webster and Dudley to future water quality problems also needs to be adequately assessed and understood. As we currently understand the situation, the low flow augmentation plan may be completely fruitless because of the combined effects of the dams and polluted sludge deposits downstream, particularly in Connecticut. In addition to oxygen depletion problems, the potential exists for toxic compounds to be added to the water column from the sludge deposits. This would defeat the purpose of the low flow augmentation plan unless the dams and/or sludge beds were removed. It is our understanding that neither EPA or the Corps has the authority to remove these sludge deposits and further, that neither of the two states involved intend to fund such a venture to clean up the French River.

The proposal to clear and grub the augmentation pool would eliminate the existing potential of the area to be developed into a marsh environment suitable as a waterfowl production area. We remain unconvinced that clearing and grubbing are absolutely necessary in a low flow augmentation plan.

Based on the issues presented in this letter, I find it in the best interests of this Service and the wildlife area at Hodges Village Dam to wait until adequate information becomes available to adequately and satisfactorily address the issues raised in this letter. Once this has been accomplished, we will be in a position to effectively deal with the alternatives available to us for the conservation and development of the fish and wildlife resources at Hodges Village Dam and the French River. Therefore, I cannot, at this time, concur with efforts to modify or terminate the General Plan.

Sincerely yours,

ACTING Regional Director

The Commonwealth of Massachusetts
Water Resources Commission
Division of Water Pollution Control
110 Tremont Street, Boston 02108

OFFICE OF THE DIRECTOR

January 29, 1979

Colonel John P. Chandler, C.E.
Division Engineer
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Re: Low Flow Augmentation
Hodges Village Reservoir
French River Basin

Dear Colonel Chandler:

I would like to express my appreciation to you and, through you, to the members of your staff for their interest and cooperation in approaching the low flow augmentation studies on the French River being jointly undertaken by our respective staffs together with personnel from EPA.

At the most recent meeting, the question was raised as to whether the State could participate in the cost of new recreational facilities as mitigation for existing facilities which would be jeopardized by the maintenance of a pool for low flow augmentation. I understand that the Corps can and will participate in such costs up to 50%.

In my opinion, this Division has both the authority (Section 39 of Chapter 21 of the General Laws) and the funds (Chapter 747 of the Acts of 1970) to participate in the non-Federal share of the facilities necessary to provide for a low flow pool at the Hodges Village Reservoir.

I trust that this assurance is sufficient at this time to permit your continuation of the studies of this most necessary project. I would appreciate an early indication of the magnitude of the costs of the work under consideration.

Very truly yours,

Thomas C. McMahon
Director

TCM/WAS/rew

cc: Richard Kotelly, Deputy Director, Water Programs Division, Environmental Protection Agency, John F. Kennedy Building, Boston 02203
Mr. Paul Dadak, Permits Branch, Environmental Protection Agency, John F. Kennedy Building, Boston 02203

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

11/17/77

Mr. Joseph L. Ignazio, Chief
Planning Division
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Mr. Ignazio:

As requested by the Corps of Engineers, we have calculated water quality benefits attributable to the proposed Hodges Village low flow augmentation project. If a continuous flow of 22 cfs is maintained at the USGS gage in Webster, the annual savings in wastewater treatment cost is $618,000 calculated over a 20-year wastewater facility life. The assumptions behind these calculations are enumerated on the attached sheets.

The water quality information used is based on a memorandum transmitted to Mr. Richard DiBuono of the Water Control Branch, New England Division, Corps of Engineers on November 9, 1977 by the Massachusetts Division of Water Pollution Control. Based on this water quality information and the economic analysis, it appears that low flow augmentation is an environmentally and economically sound proposal.

Sincerely yours,

Richard P. Kotelly

Richard P. Kotelly
Deputy Director
Water Programs Division

attachments

cc: Thomas C. McMahon - Mass. DWPC
Robert B. Taylor - Conn. DEP
Jennie Bridge - NEIWPCC

THE OXFORD PUBLIC SCHOOLS

OXFORD, MASSACHUSETTS 01540

IRWIN POTTLE, Principal
Oxford High School, 987-8127
NANCY JODREY
Supervisor of Elementary Education, 987-0246
ANN RICHARDSON
Supervisor of Special Services, 987-0246
DANIEL IVASCYN
Business Manager, 987-0246

STANLEY SEDOR, Principal
Middle School, 987-8740
DORIS BOYLE, Principal
Chaffee School, 987-2928
EDWARD CONNOLLY, Principal
Barton School, 987-2835
VINCENT PALERMO, Principal
Joslin School, 987-9962

DR. FRANCIS G. DRISCOLL Superintendent of Schools
(617) 987-0246

August 10, 1978

Col. John Chanler
Division of Engineers
U.S. Army Corps of Engineers
New England Division
424 Traplo Road
Waltham, Mass. 02154

Dear Col. Chanler:

I have recently talked briefly with Mr. Douglas Cleveland concerning our desire to file an application for Federal Funding to expand existing Educational and Recreational Programs on government owned land, otherwise known as "Hodges Village Dam." He has referred me to your office for initial review. The specific land area is located directly behind our High School. Last year, the Oxford School Department initiated and entered into a leasing agreement with the Corps of Engineers for the purpose of utilizing this area for a variety of Community Educational and Recreational Programs. In fact, work has been recently completed under a C.E.T.A. Grant, (Comprehensive Employment Training Act) entitled "Project Teach"; (Todays, Educational Advancements Through CETA Hands). This project included the development of a nature trail, outside science laboratories, cross country course, cross country ski trails and an expansion of our physical education program including a major climbing and rope course.

All above work was completed in accordance with procedures outlined by your field people; namely Mr. Stanley Alexander and Cathy Higgins. It is extremely important to us that the existing natural environmental setting of this land area remain as is. We believe that we are meeting one of the Massachusetts State Education Department's top priorities in public education, that being environmental education. This concept of education affects all members of our community, both young school age children and older senior citizens alike, and it is through the utilization of this land area that we wish to expand our School/Community Program to include an indoor-outdoor science building to serve as a natural wildlife sanctuary thus providing a truly unique educational and recreational experience to all members of our community.

Col. John Chanler

It is with the above in mind that we seek your assistance and guidance and request that you accept our invitation to meet and view the existing facilities and explore possible financial assistance programs.

Your consideration with respect to this matter will be deeply appreciated.

Very truly yours,

DANIEL W. IVASCYN
Asst. Supt. for Business Affairs

DWI/cw

CC: Mr. Stanley Alexander, Basin Manager

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
P. O. Box 1518
Concord, New Hampshire 03301

April 10, 1978

Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Sir:

This planning aid letter has been prepared to assist you in your planning efforts on the modification of the Hodges Village Reservoir, Oxford, Massachusetts. It has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). Some of the following information is adapted from an earlier Fish and Wildlife Service Report dated March, 1958.

PROJECT DESCRIPTION

The Hodges Village dam and reservoir is a single purpose flood control project on the French River. It is located in the town of Oxford, Massachusetts, in the upper Thames River Basin.

The project lies in the rolling hill section of south central Massachusetts. It is situated in an interval of a north-south valley flanked by low hills. Topographic relief in the vicinity of the project varies from elevation 460 to over 800 feet (msl). French River is approximately 22 miles in length and drains a 30 square-mile area above the project site. The river averages 20-40 feet in width within the project site. The flow is sluggish to moderately fast with many reaches that are deep and smooth flowing. Stream depth varies from one to several feet, depending upon the gradient. The stream bottom has variable substrates composed of mud, gravel and rubble. Some industrial and domestic pollution enters the main stem upstream from the dam site. Wellington Brook, the principal tributary within the reservoir area, varies in width from 6 to 15 feet, and flows through the two dry Pope Pond flowages, both of which are within the maximum flow line. Wellington Brook is a non-turbid, unpolluted stream.

Soils of the area are mainly of the Gloucester type, belonging to the Gray-Brown Podzolic Great Soil Group, predominately dark brown in color and coarse in texture. Development of the soil has been principally from material derived from crystalline schists and gneisses and accumulated by glacial action. Some peat deposits exist in the lower basin within the reservoir site.

PROJECT PLAN

The U. S. Environmental Protection Agency (EPA) and Massachusetts Division of Water Pollution Control evaluated water quality tests on the French River. They determined that treatment levels exceeding best available and economically achievable waste treatment technology would be required in order to secure the national goal of Class B waters (i.e., swimmable, fishable) by 1983.

The Corps of Engineers (CE) was authorized to undertake a feasibility study on providing streamflow regulations for water quality control from the Hodges Village Reservoir. This authority was provided by Section 216 of the Flood Control Act of 1970, Title II of Public Law 91-611. The EPA estimated potential reduction in the refined treatment levels would result in an annual savings in treatment cost of $172,000.

The plans developed for the project include the modification of the existing Hodges Village Flood Control project to accommodate an augmentation pool to be used for water quality improvement. The minimal acceptable volume of water for this purpose would provide 22 cfs flow during critical low flow periods (July and August), and inundate approximately 275 acres (el. 478 msl). The maximum acceptable volume (before it interferes with flood storage) would provide 36 cfs and inundate approximately 425 acres (486 msl). The plan also calls for clearing and grubbing the area to be inundated in order to maintain high water quality standards.

In addition, we understand that advanced treatment at Webster-Dudley, along with the removal of dams below Webster, would be necessary in order to provide a viable means towards meeting the 1983 goal. The major beneficial effort of dam removal is to increase stream velocity which, in turn, increases re-aeration. The sludge deposits which have accumulated behind the dams would be washed away, reducing the major algae problem areas.

The Perryville Dam in Webster presents the combined problems of sludge deposits and potential algae problems. The mill which used this dam burned down several years ago. Removal of this dam, however, would simply move the problems downstream to the Wilsonville impoundment in Connecticut. There are three more dams downstream of Wilsonville before the French River joins the Quinebaug. Removal of all of these dams and sludge deposits should be considered. As long as any remain, nutrient removal will definitely be required at Webster-Dudley. The major impact from sludge removal would be a temporary increase in turbidity, smothering of aquatic organisms and an increase in the biological oxygen demand. If this action is considered, the sludge deposits should be removed before the dams.

FISHERIES SECTION

Without the Project

The present fishery in the project area consists entirely of warm-water species, namely: chain pickerel, yellow perch, brown bullhead and bluegill. Historically, water quality has been such that trout stocking programs would have been futile. Recent years have seen improvement in water quality to a point where trout stocking is contemplated by the Massachusetts Division of Fisheries and Wildlife.

In 1975, it was estimated that 3,800 persons utilized the reservoir area for fishing. We anticipate this figure to increase yearly as the demand for this type of recreation increases. We would also anticipate the initiation of a trout stocking program especially in the upper reaches of the French River.

Water quality problems in the lower portion of the watershed (Connecticut) preclude heavy usage at this time. Our investigation reveals a latent demand by several thousand people who would utilize the river for all potential forms of recreation once conditions are improved.

It is estimated by Connecticut fishery personnel that this section of river could be stocked with approximately 3,000 brook and brown trout which would support an estimated 2,200 man-days of fishing. Before this potential could be realized, however, public access, which is now lacking, would have to be provided.

With the Project

Efforts to improve water quality above the reservoir will enhance the opportunity for a trout stocking program. These improvements, however, will occur with or without the project. Fishing potential of the recreation pool will be directly related to the size of the pool; however, the planned clearing and grubbing will drastically reduce the overall carrying capacity of this area. As previously indicated, the lower portion of the river could provide an estimated 2,200 man-days of fishing with a latent demand of several thousand man-days for other recreational uses.

WILDLIFE SECTION

Without the Project

The dominant vegetative types are mixed hardwoods and softwoods, with mixed oaks predominating in the hardwood group and white pine in the softwood group. Wooded swamps are characterized mainly by red maple, American elm and black alder with an understory of blueberry, dogwood, arrow-wood, buttonbush and other wetland species. A 25-acre, white cedar swamp and several small bogs are included on the site.

Open grass marsh or open wet meadow is found on the old Howarth Mill Pond and Lower Pope Pond flowages and on the wide flat at the junction of French River and Wellington Brook. This vegetative type is characterized mainly by soil waterlogged to its surface or within a few inches of its surface.

Agriculture is unimportant and there is only one small 6-acre hay field in the project area. The remaining acreages are composed of homesites (comprising about 50 acres, most of these are new developments), gravel pits, old fields and upland shrubs.

Stumpy pond is included within the maximum flow line. It is clear, spring fed and extremely shallow, supporting a lush growth of submerged and floating aquatic vegetation, consisting of Typha spp, Potomogeton spp., Carex spp., Pontederia spp. and Scirpus spp.

Several game animals and numerous non-game species make use of the site. Deer range the area, but since it is located in a region of the state supporting a low deer population, their use is light. Habitat suitable for grouse is extensive, covering a large portion of the site. The mast-producing oaks, uneven-aged woodland and much edge type are habitat features important in maintaining a grouse population. Suitable cover for cottontails is less extensive and for the most part is confined to the lower slopes and flatland. Much of the oak and white pine on the upper slopes is unsuited to cottontail occupancy because of the general lack of understory and ground cover. Gray squirrels are well distributed over the oak-covered slopes, and some cover suitable for woodcock is located along French River and Willington Brook. Suitable muskrat habitat exists along slow-flowing, meandering segments of the French River, along a short reach of Wellington Brook and in portions of drainage ditches. In addition to the muskrats, minks and otters occasionally range the site. Raccoons and foxes range freely through the section.

Waterfowl make use of the slow flowing portions of the French River and the drainage ditches. The main stem lacks a marshy or feathery edge and is also deficient in floating and submerged vegetation. Shrubby bank cover is generally heavy. There is considerable human activity in the project area so that ducks are disturbed constantly. Stumpy Pond offers a small amount of suitable waterfowl habitat. Several acres of waterfowl habitat existed at the upper end of Howarth Mill Pond before the dam was breached. Wood duck nesting boxes that had been erected in the shallow marsh are now on wet meadow. Before the drainage project, several acres of good shallow waterfowl and muskrat marsh were found on Lower Pope Pond flowage. The major limiting factor for waterfowl production is the lack of water during critical periods; i.e., nesting and migration periods, and human disturbance.

The Massachusetts Division of Fisheries and Wildlife has a 25-year license for 676 acres which it managed for hunting, fishing, and other forms of recreation. The Division annually releases approximately 500 pheasants and 100-150 hare at the reservoir. It was estimated that in 1975, the management area supported 6,300 man-days of hunting for all species.

A wide variety of non-game species utilize the project area. Table 1 lists those species known or suspected to occur within the flood control area.

Total visitations for non-consumptive recreational purposes in 1975, approximated 55,000 visitor days.

Table 1. Non-game species known or suspected to occur.

Avifauna*	Amphibians	Reptiles
Green heron	Newt	Snapping turtle
Canada goose	Spotted salamander	Wood turtle
Mallard	Dusky salamander	Spotted turtle
Black duck	Red backed salamander	Musk turtle
Wood duck	Two-lined salamander	Painted turtle
Red-tailed hawk	American toad	Red-bellied snake
American kestrel	Fowler's toad	Delay's snake
Ruffed grouse	Spring peeper	Water snake
Ring-necked pheasant	Grey tree frog	Garter snake
Spotted sandpiper	Pickerel frog	Ribbon snake
Rock dove	Leopard frog	Hognose snake
Mourning dove	Wood frog	Ringneck snake
Yellow-billed cuckoo	Green frog	Black racer
Black-billed cuckoo	Bullfrog	Green snake
Great horned owl		King snake
Belted kingfisher		
Common flicker		
Hairy woodpecker		
Downy woodpecker		
Eastern kingbird		
Eastern phoebe		
Least flycatcher		
Eastern wood pewee		
Tree swallow		
Bank swallow		
Rough-winged swallow		
Barn swallow		
Blue jay		
Common crow		
Black-capped chickadee		

Table 1 (continued)

Avifauna*	Amphibians	Reptiles
Tufted titmouse		
White-breasted nuthatch		
House wren		
Mockingbird		
Gray catbird		
Brown thrasher		
American robin		
Wood thrush		
Veery		
Cedar waxwing		
Starling		
Red-eyed vireo		
Black and white warbler		
Yellow warbler		
Chestnut-sided warbler		
Prairie warbler		
Ovenbird		
Common yellowthroat		
American redstart		
House sparrow		
Redwinged blackbird		
Northern oriole		
Common grackle		
Brown-headed cowbird		
Scarlet tanager		
Cardinal		
Rose-br. grosbeak		
Indigo bunting		
Purple finch		
American goldfinch		
Rufous-sided towhee		
Field sparrow		
Swamp sparrow		
Song sparrow		

There are no known or suspected rare or endangered species in the project area.

*Probable nesting species only, includes game birds.

With the Project

The project as described in the POS would have disastrous effects on wildlife resources. Clearing and grubbing of 425 acres in the reservoir area would create a rather sterile environment for wildlife resources. The lesser of the plans, i.e., 22 cfs, would require clearing of an estimated 190 acres, which would proportionately reduce the impacts on wildlife resources.

The net result would be the elimination of a diverse complex of habitat types which currently support a wide variety of wildlife species. Commensurate with this loss is the reduced opportunity for observation, hunting, trapping, and other wildlife recreational pursuits in the area.

Since the planning agency does not propose to hold a significant permanent pool at this reservoir, we might expect some wildlife values to be retained on the lower portion of the reservoir area; however, it would be insignificant compared to the total area.

DISCUSSION

It is obvious that much more information will have to be provided before this Service can fully evaluate the total impacts of this project. A critical unknown impact is the removal of the dams below Webster, which we understand to be an integral part of the water quality improvement scheme. We request that as much information as possible regarding this aspect of the project be provided to us for analysis in our final report. In addition, details on advanced treatment plant construction and alternatives such as land disposal methods must be provided.

A major alternative, which has not been considered at all, is the construction of dikes and holding ponds within the reservoir area. This, in effect, would create a tertiary treatment impoundment. We feel that this alternative has potential in helping to relieve the water quality problems. It would also have the least environmental impact and could provide some real benefit to fish and wildlife resources. We would certainly consider this alternative as part of the environmental quality plan based on available information and potentially the final plan.

Section 208 of P.L. 92-500 mandates that a Water Quality Management Plan be prepared in this project area. We understand that this 208 plan will be finalized by June, 1979. We fell that planning for this study must be coordinated and be compatible with the recommended methodologies to be presented and adopted in that plan.

Regarding the information presented in the POS, we feel an optimum water level retention and a controlled flow release program will be necessary in order to minimize adverse impacts of the project on fish and wildlife resources.

Water level elevations must be thoroughly studied in order to choose a level which maximizes 1-2 feet depths throughout the area for waterfowl utilization. In order to accomplish water retention and limited control, a combination of dikes, berms, and water control structures would be necessary.

Water level stability during critical life stages of wildlife will be essential to maximize productivity. It is, therefore, essential that the Massachusetts Division of Fish and Wildlife have integral control over water level fluctuation as much as possible.

In order for this agency to define the proper water level requirements it will be necessary to obtain a basin map with 2-foot contour intervals and detailed flow and flood frequency analysis.

The clearing and grubbing aspect of the project plan raises much concern with this agency, and we feel that it should only be used after all other alternatives have been eliminated. If no alternative exists, we would recommend that only a minimum of clearing and grubbing be utilized and be confined to the lower section of the project area.

Judicious disposal of the spoil material would be necessary in conjunction with this project. We feel that some of this material can be utilized in creating nesting and loafing islands for waterfowl and possibly in forming some of the dikes and berms. Surplus material must be suitably contained on an upland site.

SUMMARY

In summary, the project as presented in the POS would have significant effects on fish and wildlife resources. Modified to incorporate appropriate alternatives, planning and mitigation measures, the project could enhance management opportunities for certain fish and wildlife resources. These mitigation measures will be detailed in our final report. It is essential, however, that all alternatives be fully explored and presented as required by the Water Resource Council's, Principles and Standards. These alternatives should be addressed before stage III of the planning process is completed so that we may fully weigh their environmental impacts.

In addition, the material and information cited previously should be provided this office as soon as possible for evaluation in the final report.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor

ELLA GRASSO
GOVERNOR

STATE OF CONNECTICUT
EXECUTIVE CHAMBERS
HARTFORD

February 24, 1978

Colonel John P. Chandler
Division Engineer
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Chandler:

I am pleased to have received your letter concerning the proposed modification project at the Hodges Village Dam and Reservoir in Oxford, Massachusetts.

I am assigning Commissioner Stanley J. Pac and the Department of Environmental Protection as the state's lead agency and contact for this project.

I look forward to further cooperation with the Corps of Engineers in the investigation of the proposed modification project of the Hodges Village Dam and Reservoir.

With best wishes,

Cordially,

Ella Grasso

ELLA GRASSO
Governor

The Commonwealth of Massachusetts
Water Resources Commission
Division of Water Pollution Control
110 Tremont Street, Boston 02108

Water Quality and Research Section
P. O. Box 545
Westborough, Massachusetts 01581

November 9, 1977

Mr. Richard DiBuono, Water Control Branch
New England Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Dick:

Enclosed is a copy of a memorandum by Mark Pare of the Division's Water Quality and Research Section pertaining to your request for the reevaluation of the proposed Hodges Village Impoundment. I hope it will answer your questions relative to this project.

If you need any additional information, please feel free to contact either Mark or myself.

We appreciate the Corps' efforts in conducting this study and look forward to working together in the future.

Very truly yours,

Alan N. Cooperman

Alan N. Cooperman
Associate Sanitary Engineer

ANC/MKP/rg
Enclosure
cc: ~~Eric~~ Hall, EPA
Clyde Shufelt, EPA
Carmine Cirrello, Corps of Engineers

MEMORANDUM

TO: Alan N. Cooperman

FROM: Mark K. Pare

DATE: November 7, 1977

SUBJECT: Hodges Village Flow Augmentation Project

In response to a request by the New England Division of the U.S. Army Corps of Engineers, the Water Quality and Research Section reevaluated the calculations on the quantity and quality of flow necessary to maintain water quality standards in the French River.

Initial work on this project took place back in 1974 when it was determined that even with advanced waste treatment at the Webster and Dudley Wastewater Treatment Plants, water quality standards for the French River would not be met below these discharges during certain critical flow conditions. At that time, a mathematical simulation model of the river was ultilized to calculate the quantity and quality of additional flow necessary to maintain minimum criteria of the existing water quality standards. A preliminary study by the Corps of Engineers indicated that a flow of 36 cfs could be maintained at the Webster gage by creating a permanent pool behind the Hodges Village Dam. The model predicted that, at that flow with the assumption that the site of the pool will be cleared of organic matter to assure high quality water in the pond, class B criteria could be maintained if the Webster and Dudley facilities could meet the following effluent limits.

	FLOW (MGD)	BOD_5 (mg/l)	NH_3 (mg/l)	TOTAL P (mg/l)	D.O. (ml/l)
Webster	6.33	7.0	1.7	1.0	6.0
Dudley	0.7	7.0	1.7	1.0	6.0

Reevaluation of the 36 cfs value was requested by the Corps after an analysis of the available water quality data for the French River led them to believe that conditions in the proposed Hodge Village Project may be similar to the conditions in West Thompson Lake. A report on that analysis suggested that nutrients in the French River above the project site will be sufficient to cause algae blooms. It indicated that clearing, stripping and even grubbing the land to be inundated by the impounded waters will not be enough to prevent these growths.

An overall view of this situation suggests the Corps assumption that the two impoundments may be similar could be incorrect. In terms of pollutional loadings, the West Thompson Dam impounds waters which carry wastes from West Dudley Paper, American Optical, Southbridge STP, Charlton City STP, Charlton Woolen and Sturbridge STP, while the French River above Hodges Village only receives discharges from Oxford-Rochdale STP and Leicester STP. The Leicester facility will be required to provide advanced treatment (including nutrient removal) or elimination of the plant with connection of the system to the Upper Blackstone District. Investigations are presently underway to evaluate the possibilities of a sewerage system in the Town of Oxford. If this system comes about the Oxford-Rochdale plant will be replaced by a new facility which will discharge below Hodges Village; otherwise, the Oxford-Rochdale plant will also be required to provide advanced treatment. In view of the above, waters impounded by the Hodges Village Dam can be assumed to contain only background levels of nutrient for purpose of this study.

A factor which should be considered at this point, however, is the fact that the Massachusetts Water Quality Standards are presently being revised. Under the proposed revisions, the dissolved oxygen requirements for class B streams will be changed from not less than 75% of saturation for 16 hours of any 24 hour period and never less than 5 mg/l to a minimum of 5.0 mg/l at all times. If these revisions are adopted, the required instream concentration of D.O. can be lowered from 6.3 mg/l (75% of satuation at 77°F) to 5.0 mg/l. This difference of 1.3 mg/l greatly influences the quantity (or quality) of flow required.

Computer runs using the same simulation model with this lowered instream dissolved oxygen criteria indicate the flow at the Webster gage may be as low as 22 cfs if fairly good water quality can be maintained; that is, the water leaving the impoundment must have a BOD_5 lower than 3.0 mg/l and a D.O. of at least 6.0 mg/l. A BOD_5 as high as 5.0 mg/l and D.O. as low as 5.0 mg/l can achieve approximately the same instream results with a flow of 36 cfs at the Webster gage.

In summary a reevaluation of the Hodges Village Flow Augmentation Project indicates that if the proposed Massachusetts Water Quality Standards are adopted and if it can be assumed that the area to be inundated by the project is properl cleared, stripped and grubbed, the flow required at the Webster Gage to maintain water quality standards below the Webster and Dudley Wastewater Treatment Plant can be as low as 22 cfs. Otherwise, the former value of 36 cfs must be maintained.

MP/rg

ELLA GRASSO
GOVERNOR

STATE OF CONNECTICUT
EXECUTIVE CHAMBERS
HARTFORD

December 21, 1976

Colonel John P. Chandler
Corps of Engineers
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Chandler:

Thank you for informing me of the status of the funds to initiate a study of the existing Hodges Village Flood Control Dam in Oxford, Massachusetts, relative to improving water quality downstream from the dam.

It is the position of the State of Connecticut and the Department of Environmental Protection that pollution of the French River can be considerably ameliorated through the construction of advanced wastewater treatment systems to serve the towns of Webster and Dudley, Massachusetts. It is also the state's position that low flow augmentation may supplement these advanced wastewater treatment systems in further improving the condition of the water quality during the summer, but low flow augmentation cannot, in itself, be considered a substitute for the required facilities. We are pleased, therefore, that a study of the supplemental low flow augmentation is being conducted by the Corps of Engineers, and we shall cooperate in supplying any information you may require.

I wish to call your attention to Section 25-101 and Section 25-102 of the Connecticut General Statutes, a copy of which is enclosed. These sections of Connecticut law established the Thames River Valley Flood Control Commission which is responsible for managing all activities concerning the

Hodges Village Dam. The State of Connecticut and the Commonwealth of Massachusetts have agreed to certain conditions as set forth in the statutes.

If there are any changes contemplated in the function of the Hodges Village Dam, any present agreements between the State of Connecticut and the Commonwealth of Massachusetts would have to be reviewed. Mr. William Wise, 37 Bishop Road, West Hartford, Connecticut, is a member of the Thames River Valley Flood Control Commission to whom correspondence may be addressed. The Department of Environmental Protection's Water Resources Unit and Water Compliance Unit have regulatory authority in these matters and also should be informed of all developments.

We appreciate the Corps' efforts in conducting this study.

With best wishes,

Cordially,

Ella Grasso

ELLA GRASSO
Governor

WASHINGTON OFFICE:
129 CANNON HOUSE OFFICE BUILDING
WASHINGTON, D.C. 20515
(202) 225-2076

DISTRICT OFFICE:
STANLEY ISRAELITE
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340 MAIN STREET
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Congress of the United States
House of Representatives
Washington, D.C. 20515

July 9, 1976

SUBCOMMITTEES:
IMMIGRATION, CITIZENSHIP AND INTERNATIONAL LAW
CIVIL AND CONSTITUTIONAL RIGHTS

SCIENCE AND TECHNOLOGY

SUBCOMMITTEES:
SCIENCE, RESEARCH AND TECHNOLOGY
ENERGY RESEARCH, DEVELOPMENT AND DEMONSTRATION

BOARD OF VISITORS TO THE UNITED STATES COAST GUARD ACADEMY

Colonel John H. Mason, Division Engineer
Corps of Engineers
Department of the Army
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Mason:

Since it has been determined that low flow augmentation would be necessary for the French River and its waste treatment problems, I would be most appreciative if the Corps were to undertake a study to provide this low flow augmentation for the French River.

Please accept my sincere thank you for your consistently kind and immediate cooperation with my District office in Norwich. Stanley Israelite has told me many times of the efficient way in which you and your staff handle the many matters that come before us in the District.

Sincerely yours,

CHRISTOPHER J. DODD
Member of Congress

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

April 15, 1976

Mr. Carmine Ciriello, Project Chief
Plan Formulation Branch
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Ciriello:

Enclosed is a report on the preliminary evaluation of low flow augmentation and advanced wastewater treatment as alternatives for achieving water quality objectives of the French River.

The report concludes that low flow augmentation, in combination with advanced waste treatment, presents an economical alternative to advanced waste treatment alone. It is estimated that the potential reduction in the required treatment levels would result in an annual saving in treatment cost of $172,000.

You should be cognizant that the analysis is based on the best available data collected prior to the operation of the Webster secondary treatment facility. Further refinement may be necessary when more current data becomes available.

Sincerely yours,

Walter M. Newman, Chief
Water Quality Branch

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

December 30, 1975

Mr. Carmine Ciriello, Project Chief
Plan Formulation Branch
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Ciriello:

This letter will confirm discussions between staff members of the Corps, Massachusetts Division of Water Pollution Control and EPA, held on December 8, 1975, for the purpose of outlining future steps for dealing with the water quality problems of the French River.

Based upon these discussions, the following was established:

1. Preliminary water quality evaluations by the Massachusetts Division of Water pollution Control and EPA indicate that treatment levels exceeding best available waste treatment technology economically achievable may be required in order to secure the national goal of fishable-swimmable waters in the French River.

2. Stream low flow augmentation is a viable alternative complimenting best available waste treatment technology economically achievable for achieving water quality objectives.

3. The Corps of Engineers may be able to provide augmented streamflow from the existing flood control reservoir at Hodges Village. However, it would be several years before this could be accomplished.

4. EPA and the Division of Water Pollution Control will prepare a status report on alternatives for achieving water quality objectives in the French River. The report should be available within a few weeks.

In summary, then we recommend the Corps undertake feasibility studies on providing streamflow regulation for water quality control from the Hodges Village Reservoir. We look forward to cooperating with the Corps in these studies.

Sincerely yours,

Walter M. Newman, Chief
Water Quality Branch

CC: Mass DWPC
Central Mass 208
Conn. DEP

The Commonwealth of Massachusetts
Water Resources Commission
State Office Building, Government Center
100 Cambridge Street, Boston 02202

OFFICE OF THE DIRECTOR
DIVISION OF WATER
POLLUTION CONTROL

October 2, 1970

Mr. John Wm. Leslie, Chief
Engineering Division
Corp of Engineers
424 Trapelo Road
Waltham, Massachusetts

Re: Request for low flow study,
French River, Thames River Basin

Dear Mr. Leslie:

This Division has made preliminary estimates of the need for flow augmentation in the French River below Webster, Massachusetts. It has been determined that a minimum flow of 36 Cfs at the Webster gauge would be required to attain Water Quality Standards assigned this reach of the River. This figure based on secondary treatment of all municipal wastes and equivalent treatment of industrial wastes prior to discharge.

It is requested that you examine the possibility and feasibility of utilizing storage in the Buffumville and/or Hodges Village Reservoirs to provide this minimum flow. By copy of this letter, we are apprising the Federal Water Quality Administration of this request.

If members of your staff assigned this project have any questions, I would suggest they call Mr. Slagle of this Division.

Very truly yours,

Thomas C. McMahon

Thomas C. McMahon
Director

TCM/WAS/kp
cc: Mr. Bartlett Hague
New England Basins Office
Federal Water Quality Administration
240 Highland Avenue
Needham Heights, Massachusetts 02194

INCLOSURE 4

OUTLINE AND SCHEDULE OF WORK

EXHIBITS

ANTICIPATED WORK EFFORTS REQUIRED TO COMPLETE THE FEASIBILITY STUDY

Work effort to complete the Feasibility Report will consist primarily of the following:

. Review authorizing documents and other Federal and non-Federal reports and correspondence related to the project.

. Refine the low flow augmentation plan by conducting more detailed geotechnical, water quality and other engineering studies.

. Refine the economic (including cost, benefit and benefit-cost ratio), social and environmental impacts of the low flow augmentation plan.

. Evaluate the relationship of reservoir regulation and the proposed 10.1 foot seasonal pool.

. Assess the need to require additional real estate in fee or by establishing flowage easements.

. Incorporate other uses such as recreation into the low flow augmentation plan.

. Coordinate the flow augmentation plan with the public and mitigate controversial areas of concern.

. Determine Federal and non-Federal allocation of costs.

. Assess the capability of non-Federal interests to provide cash contributions, if required, and to satisfy any other local cooperation requirements.

. Based on the assessment and evaluation of data, select a plan, and, if appropriate recommend it for Congressional authorization.

. Prepare a Feasibility Report including a DEIS.

. Coordinate the draft report and DEIS with CEQ and the public.

. Submit the final Feasibility Report and RDEIS to OCE and BERH and release a public notice of completion of the feasibility study.

Planned Fish and Wildlife Mitigation Efforts - Stage 3

Hodges Village Low Flow Augmentation Study, Oxford, Massachusetts

The following is an elaboration on page 4-1 of the Report for Issue Resolution (RFIR), titled Anticipated Work Efforts Required to Complete the Feasibility Study. While not outlined specifically in the RFIR, fish and wildlife mitigation studies are planned for Stage 3 of the feasibility study.

It is important to note that fish and wildlife concerns have been considered throughout the planning study. Coordination has been maintained with both the U.S. Fish and Wildlife Service (FWS) and the Massachusetts Division of Fisheries and Game. Their inputs have made a major contribution to the development of a low flow augmentation plan that will keep stripping and clearing land to a minimum.

The greatest efforts toward fish and wildlife mitigation will be taken in Stage 3, however. FWS is scheduled to spend 4 to 5 months in early FY 1983 to determine possible effects on fish and wildlife due to a loss of wetland habitat. Available measures to minimize adverse impacts, or to enhance local fish and wildlife opportunities, both at the proposed impoundment and downstream, will be studied at this time. In addition, meetings will be held with FWS and the Massachusetts Division of Fish and Game regarding possible modifications to the general plan for fish and wildlife management at Hodges Village.

Schedule of Fish and Wildlife Mitigation Efforts

-- Fish and Wildlife Mitigation Study (FWS) OCT 82 - DEC 82

-- Preparation of Fish and Wildlife Mitigation Report (FWS) JAN 83 - FEB 83

-- Continuing coordination with FWS and Massachusetts Division of Fish and Game throughout this period.

STUDY SCHEDULE MILESTONES

Milestone Number		Date Scheduled	Date Completed
Reconnaissance Report			
1.	Study Initiation		(11-76)
2.	Approval of Reconnaissance Report		(12-77)
Feasibility Report			
3.	Submit Issue Resolution Document to OCE	05-82	
4.	Issue Resolution Conference	07-82	
5.	Completion of Action on Conference MFR	08-82	
6.	Submission of Draft Feasibility Report and DEIS to OCE	05-83	12/83 1.84
7.	Checkpoint Conference	07-83	
8.	Completion of Action on Conference MFR	08-83	
9.	Coordination of Draft Feasibility Report and DEIS	10-83	
10.	Submission of Final Feasibility Report and RDEIS to OCE	01-84	
11.	Release of Division Engineers Public Notice and Submission of Report and RDEIS to BERH	02-84	